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MILITARY SPECIFICATION

MANUAL, TECHNICAL, FOR MECHANICAL AND ELECTRICAL EQUIPMENT (LESS ELECTRONICS)

1. SCOPE.

1.1 **Scope.** – This specification covers the minimum requirements for preparing and revising technical manuals for electrical and mechanical equipment(s). The requirements for electronic equipment are covered in Specification MIL-M-16616. In addition, it covers the requirements for approval procedures; production and reproduction; quality and distribution; and packing and packaging.

1.2 **Classification.** – Technical manuals shall be of the following types as specified (see 6.1):

Type I – Type I manuals are required for experimental equipment procured to determine either military suitability or the ability of a manufacturer to meet military specifications. (See 3.1 and 3.2)

Type II - Type II manuals are required where the equipment to be described has no direct commercial counterpart or which is sufficiently complex that more extensive information is necessary. (See 3.1 and 3.3)

Type III – Type III manuals are required where the equipment to be described is an adaptation or variation of conventional commercial equipment, where, with certain modifications and additional data, the type of instruction matter normally furnished will serve the purpose. (See 3.1 and 3.4)

Type IV – Type IV manuals are standard commercial manufacturers' instructions on relatively simple equipment which will be adequate subject to minor modifications. (See 3.1 and 3.5)

2. APPLICABLE DOCUMENTS

2.1 The following specifications, standards, drawings and publications, of the issue in effect on date of invitation for bids form a part of this specification:

SPECIFICATIONS

FEDERAL

LLL-B-631-Boxes; Fiber Corrugated (for Domestic Shipment).
LLL-B-636-Boxes; Fiber Solid, (for Domestic Shipment).
PPP-B-585-Boxes; Wood, Wirebound.
PPP-B-591-Boxes; Fiberboard, Wood-Cleated.
PPP-B-601-Boxes; Wood, Cleated-Plywood.
PPP-B-621-Boxes; Wood, Nailed and Lock-Corner.

MILITARY

JAN-P-108-Packaging and Packing for Overseas, Shipment Boxes, Fiberboard (V-Board and W-Board), Exterior and Interior.
MIL-P-116-Preservation, Methods of
MIL-B-10377-Boxes; Wood-Cleated, Veneer, Paper Overlaid.
MIL-L-10547-Liners, Case, Waterproof.

NAVY DEPARTMENT

General Specifications for Inspection of Material.

STANDARDS

MILITARY

MIL-STD-218-2 Technical Manuals Part 2 -- Production or Procurement of Artwork for Technical Manuals.
MIL-STD-218-3 Technical Manuals Part 3 -- Preparation of Manuscript (Final, Typed) for Technical Manuals.
MIL-STD-12 Abbreviations for use on Drawings.
MIL-STD-15 Electrical and Electronic Symbols.
MIL-STD-16 Electrical and Electronic Reference Designations.
MIL-STD-17 Mechanical Symbols.
MIL-STD-103 Abbreviations (for Electrical and Electronic Use).
MIL-STD-129 Marking for Shipment and Storage.

DRAWINGS

BUREAU OF SHIPS

S0103-73729 -- Standard Drawing Format for Production Drawings Prepared by Contractor or Manufacturer for approval by Government Agencies.

PUBLICATIONS

DEPARTMENT OF DEFENSE

DD441 (Attachment) -- Industrial Security Manual for Safeguarding Classified Information.

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 **Other publications.** -- The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

CONSOLIDATED CLASSIFICATION COMMITTEE

Consolidated Freight Classification Rules.

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago 6, Ill.)

3. REQUIREMENTS.

3.1 General requirements.

3.1.1 **Material.** -- The minimum material requirements shall be as specified hereinafter. A good grade of printing and materials shall be used when not definitely specified.

3.1.2 **Identification.** -- Technical manuals shall be identified by a Navy identification number of the form "NAVSHIPS 300-0000" (see figures 1 and 2). Numbers will be assigned only by the Bureau of Ships upon receipt of a preliminary copy of the manual. In urgent cases, a letter request, containing complete descriptive data of the equipment, will be honored for the purpose of assigning a NAVSHIPS number (see 3.1.8.1). This number shall be imprinted on the upper left hand corner of the cover, and printed on the upper right hand corner of the title page of all final copies of the manuals prior to distribution (see figures 1 and 2).

3.1.3 **Copyright.** – Technical manuals shall not be copyrighted. The bureau or agency concerned reserves the right to reproduce or have reproduced in part or in entirety all manuals procured under this specification.

3.1.4 **Security classification.** – The security classification of the manuals shall be as designated by the bureau or agency concerned. If classified, the security requirements of the Industrial Security Manual for Safeguarding Classified Information DD441 (Attachment) shall be followed. For classified manuals all pages shall bear appropriate security classification located as shown on figures 1 through 13. The word "UNCLASSIFIED" shall appear on each page of unclassified sections of classified manuals. Revisions (see 3.1.6) shall be classified as required by their subject matter. Revised pages (see 3.1.6.2) shall have the same classification as the original pages, unless otherwise specified by the bureau or agency concerned. Information with a security classification higher than that established in table I for a section that is considered essential shall be brought to the attention of the bureau or agency concerned. A volume shall be classified the same as the highest classification within the volume. The sections of the manual shall be classified as shown in table I, unless the bureau or agency concerned approves content with a higher classification.

TABLE I

SECTION	Equipment classification		
	UNCLASSIFIED	CONFIDENTIAL[1]	SECRET
1. General Information	UNCLASSIFIED	CONFIDENTIAL[1]	SECRET
2. Principles of Operations	UNCLASSIFIED	CONFIDENTIAL[1]	SECRET
3. Operating Instructions	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
4. Installation	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
5. Maintenance	UNCLASSIFIED	CONFIDENTIAL[1]	SECRET
6. Parts list	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
7. Drawings	UNCLASSIFIED	CONFIDENTIAL[1]	SECRET

[1]Substitute - "Confidential - Modified handling authorized" - for equipments so classified.

In addition to being marked with the appropriate security classification each classified manual shall bear the following notation printed on the title page (as shown on figure 2):

> "WARNING: This material contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law."

3.1.5 **Additional manuals.** – There shall be printed upon the title page of all final manuals the notice as shown on figure 2 advising where additional copies of the manual may be obtained.

3.1.6 **Revision to incorporate changes.** – New, revised, or supplementary pages shall be furnished until the guarantee period of the equipment expires.

3.1.6.1 **New pages.** – When it is found necessary to include new information to augment the content of the original manual, new pages shall be issued. These pages shall be identified with the following legend placed in the bottom outside corner adjacent to the page number but toward the binding edge of each page. Include on the first line, the word "New" followed by the NAVSHIPS identification number, and on the second line, the month and year of issue. New pages shall bear the same number as the page they follow and shall be further annotated using the decimal system; for example, original page 1-1-14, new pages 1-1-14.1 and 1-1-14.2 (see 3.3.2.5 for numbering). A reproduction copy of each new page shall be provided.

3.1.6.2 **Revised pages.** – If it is determined that information originally furnished in manuals must be changed for clarification, correction or because every equipment covered by the manual has been uniformly modified, revised pages shall be issued. These pages shall be identified with the following legend placed in the bottom outside corner adjacent to the page number but toward the binding edge of each page. Include on the first line, the word "Revised" followed by the NAVSHIPS identification number, and on the second line the month and year of issue. Revised pages shall bear the same number as the page they replace and if the revised information should require the use of additional pages they shall be annotated using the decimal system (see 3.3.2.5 for numbering.) A reproduction copy of each revised page shall be provided.

3.1.6.3 **Supplementary pages.** – In instances where modifications are made only to a portion of the total number of equipments covered by the manual, resulting in the need for alternate instructions to cover those items modified, this information shall be issued in the form of supplementary pages. These pages shall be identified with the following legend placed in the bottom outside corner adjacent to the page number but toward the binding edge of each page. Include, on the first line, the word "Supplementary" followed by the NAVSHIPS identification number, on succeeding lines the hull numbers of the specific ships to which the page applies and on the last line, the month and the year of issue. Supplementary pages shall bear the same number as the manual page they follow and shall be further annotated using the decimal systems; for example, original page 1-1-14, supplementary pages 1-1-14.1 and 1-1-14.2. (See 3.3.2.5 for numbering.) A reproduction copy of each supplementary page shall be provided.

3.1.7 **Time of delivery.** – Every effort shall be made to submit the preliminary manual in ample time to permit approval and final printing prior to the delivery date of the equipment (see 3.1.8.1). Two copies of each final manual shall be delivered with the first unit and each succeeding unit of equipment shipped (see 3.6). If final manuals are not available at the time of delivery of equipment, two copies of an adequate preliminary manual packed with each unit of equipment shall be furnished. In all instances where preliminary manuals are furnished in lieu of final manuals they shall be replaced with final manuals within 60 days (see 3.1.8.2.4).

3.1.8 **Preliminary manuals.** –

3.1.8.1 **Method of approval.** – Prior to printing final manuals, the manufacturer shall prepare and submit, as indicated herein, a preliminary manual, in duplicate, for approval and assignment of a NAVSHIPS number (see 3.1.2). NAVSHIPS numbers will be assigned only by the Bureau of Ships. At the time of submission of preliminary manuals, the manufacturer shall submit a letter of transmittal forwarding the preliminary manual which shall state the expected delivery date of final manuals and the quantity of manuals being furnished for stock in accordance with 3.6. The preliminary manuals shall be forwarded by the contractor to one of the following activities, as appropriate:

(a) *Manuals procured by the Bureau of Ships* - Contractor shall forward preliminary copies via the cognizant Government inspector to the Bureau of Ships for approval and assignment of a NAVSHIPS number.

(b) *Manuals procured by Naval activities other than the Bureau of Ships* – Contractor shall forward preliminary copies to the Naval activity for their approval and transmittal to the Bureau of Ships for assignment of a NAVSHIPS number.

(c) *Manuals procured for the Navy by a commercial activity (such as a shipbuilder at a private yard) or other Government agency* – Contractor shall forward preliminary manuals to the cognizant Naval supervising activity or other Government agency, as appropriate, for their approval and transmittal to the Bureau of Ships for assignment of a NAVSHIPS number.

3.1.8.2 **Contents.** –

3.1.8.2.1 **Approval and procurement record page.** – In each preliminary manual exactly identical to one previously procured and assigned a NAVSHIPS number an approval and procurement record page (see figure 3a) shall be provided and inserted immediately following the title page. In each preliminary manual not exactly identical to one previously procured and assigned a NAVSHIPS number, an approval and procurement record page (see figure 3b) shall be provided and inserted immediately following the title page.

3.1.8.2.2 **Text.** – Preliminary manuals shall consist of a complete text of the instructions required for the type of manual to be furnished.

3.1.8.2.3 **Figures.** – Preliminary manuals shall contain a list of all figures (photographs, exploded views, and drawings) and shall include sample art work (all exploded views and sketches) which will appear in the final manual. If the final manual is to include test data, or a table of weights, for example, and if any of the items are not available when the preliminary manual is issued, then a foreword shall state which items have been omitted.

3.1.8.2.4 **Manual identification.** – In all instances where preliminary manuals are furnished in lieu of final manuals, the NAVSHIPS identification number preceded by the word "PRELIMINARY" shall be stamped or hand printed on the covers of all copies of the preliminary manuals prior to distribution (see 3.1.2). This number shall be imprinted on the upper left hand corner of the cover, and printed on the upper right hand corner of the title page.

3.1.8.2.5 **Covers.** – Covers for preliminary manuals shall be at least 20 by 26-65/500 - basis gray antique finish cover stock or similar material, bellows fold, with the title and other pertinent information on the cover. This information shall be identical with that which will appear on the final manual. (See figure 1).

3.1.8.2.6 **Printing.** – The text of preliminary manuals may be printed by any quick, economical method, such as multigraph, mimeograph or similar method.

3.2 **Type I manuals.** – The preparation and contents of the type I manuals shall be as specified in the individual contract or order.

3.3 **Type II manuals.** –

3.3.1 **Contents.** – Type II manuals shall contain the following information as applicable presented in the order listed (see figures 1 to 13 inclusive).

Front matter.
Section 1 - General information.
Section 2 - Principles of operations.
Section 3 - Operating instructions.
Section 4 - Installation.
Section 5 - Maintenance.
Section 6 - Parts list.
Section 7 - Drawings.
Memorandum.

Note. – When a manual covers an equipment composed of several distinct units (for example, a generating set consisting of a diesel engine, a generator, a voltage regulator, and a controller), it may be necessary to arrange the manual in major divisions, each covering one unit. If so, the major divisions may be arranged by subdivisions, each corresponding to the requirements listed herein. The order listed herein may be altered with the approval of the Bureau or agency concerned.

3.3.1.1 **Front matter.** – The front matter for type II manuals shall consist of the following:

(a) Cover.
(b) Title page.
(c) Approval and procurement record page.
(d) List of effective pages.
(e) Correction page.
(f) Table of contents.
(g) List of figures.
(h) List of tables.

3.3.1.1.1 The list of effective pages shall be required in classified manuals only, and in multiple volume manuals shall be a separate page for the contents of each volume.

3.3.1.1.2 The title page, table of contents, list of figures and list of tables shall be a separate page for the contents of each volume.

3.3.1.1.3 **Approval and procurement record page.** – In all final copies of the manual, the manufacturer shall include an approval and procurement record page inserted immediately following the title page. Figures 3a or 3b gives the format that shall be followed in its preparation.

3.3.1.1.4 **List of effective pages.** – A list of effective pages (see figure 4) shall be prepared for all final manuals classified for security purposes (see 3.1.4) and copies thereof. For multiple volume manuals there shall be prepared a separate list for the contents of each volume.

3.3.1.1.5 **Correction page.** – A correction page (see figure 5) shall be furnished for all final manuals and copies thereof for the purpose of making revisions in accordance with 3.1.6. For multiple volume manuals there shall be prepared a separate correction page for each volume.

3.3.1.1.6 **Table of contents.** – The table of contents (see figure 6) shall list all primary divisions and secondary subdivisions such as chapters, sections, and main paragraphs, with their corresponding paragraph numbers and page numbers. Where sub-manufacturers are furnishing associated equipment it shall be the responsibility of the prime contractor to integrate and reflect the information provided by the sub-manufacturers within the table of contents.

3.3.1.1.7 **List of figures and drawings.** – A list of figures (see figure 7) which have been assigned figure numbers shall be prepared. The list shall be arranged in numerical sequence by figure number and shall give the figure title (see 3.3.3.8) and page number.

3.3.1.1.8 **List of tables.** – The list of tables (see figure 8) shall follow the list of figures and drawings. It shall include all tables assigned numbers and shall be arranged in numerical sequence by table number.

3.3.1.2 **Section 1 – General information.** – This section shall include general data, an introduction, and a detailed description.

3.3.1.2.1 **General data.** – This portion of the manual shall contain the following data:

(a) Component list and performance design characteristics: The name of each component and the respective manufacturer's name with its complete rated performance characteristics for continuous or intermittent operation and, where applicable, maximum permissible overload characteristics and their duration. In addition, a description of the the item shall be included to distinguish it from other items of the same general category. For instance, a motor shall be distinguished as to the specific type of motor for example, as a.c., synchronous, totally enclosed, etc.

(b) Navy type designation.
(c) Principal overall dimensions.
(d) Weights (with or without packing).
(e) Allowable clearances, temperatures, pressures, pressure and blow range settings or tolerances shall be shown in tabular form.

3.3.1.2.2 **Introduction.** – This division shall include a general description of the equipment; explain briefly what it is, where it is used, what it will do, and the general overall and interrelated operation of the various units. All information of a general character applicable to the complete equipment shall also be given. Where the text contains technical terms, terms not commonly used, or symbols, definitions shall be included.

3.3.1.2.3 **Detailed description.** – This division shall contain a complete detailed description of units and assemblies which comprise the complete equipment; for example, ship service turbogenerator, the turbine, reduction gear, generator and exciter.

3.3.1.2.4 **Section 2 – Principles of operation.** – This division shall contain a brief resume of the principles of operation. Figures, sketches, performance curves, and schematic wiring diagrams shall be included to convey an understanding of the function and operation of the equipment (see 3.3.1.2.9).

3.3.1.2.5 **Section 3 – Operating instructions.** – Information shall include routine and emergency procedures, and safety precautions; maximum and minimum loads; normal temperature or pressure limits or both; trans-

for from manual to automatic operation (or the reverse), to be observed in the starting, operating, stopping, and shutting down of the equipment. In addition, action(s) shall be described which should be taken in the event of power failure; control air failure; generating tube failure; lube-oil failure; steering gear failure; partial failure of equipment; and similar conditions. Action(s) described in the event of partial failure shall include, where practicable, those procedures necessary to provide continued service of the equipment until an opportune time is available to repair the equipment. Where operating procedures are to be performed in specific sequence, step-by-step procedures shall be given. Operations shall be numbered in the order in which they are performed. Operating data which is frequently referred to in operating the equipment shall be included. Tables and charts shall be used for the presentation of these instructions where varying operating conditions are encountered.

3.3.1.2.6 **Section 4 – Installation.** – This division shall contain methods of installation, including packing or unpacking, handling, preparation of foundation, alignment, precautions, mounting instructions, bolting diagrams, recommendations regarding shielding, safety guards, grounding or bonding.

3.3.1.2.7 **Section 5 – Maintenance.** –

3.3.1.2.7.1 **Preventive maintenance.** – This division shall cover all maintenance procedures, inspection, tests, test data, and adjustments which should be performed periodically and regularly for the purpose of preventing failure or impairment of the equipment. Routine maintenance check charts or instructions or both shall be provided. They shall include, but shall not necessarily be limited to the following:

(a) A tabulation of periodic, routine, mechanical, and electrical tests and checks which should be accomplished regularly to insure continuity of service at optimum performance.
(b) Tables or charts or both to indicate what is to be done, when it is to be done, and how to do it.
(c) Utilization of the test facilities which may be incorporated in the various components.
(d) Instructions for the care, inspection, and cleaning of all pertinent parts.
(e) Instructions stressing the importance of properly maintaining any safety devices or interlocks provided to prevent damage to equipment or injury to personnel.
(f) Instructions on lubrication shall be provided as applicable, preferably in chart form. They shall include information regarding lubrication recommended by the manufacturer, the type of lubricant to be used, together with specific time periods. Lubricants shall be described by Military specification numbers where applicable and by commercial designations.

3.3.1.2.7.2 **Corrective maintenance.** – This division shall cover all information necessary to permit a technician to locate trouble, and to make repairs, adjustments and conduct tests of each component, assembly or sub-assembly of the equipment upon initial installation or under other conditions such as after major overhaul where complete readjustment may be required. Included in this division shall be the following:

(a) Trouble shooting guides for the localization of faults giving possible sources of trouble, the symptons, probable cause, and instructions for remedying the faults.
(b) Complete instructions on signal tracing for electric circuits, use of test instruments and other common servicing techniques.
(c) Ample figures, photographs, exploded views giving details of mechanical assemblies, and simplified schematic diagrams of electrical, mechanical, hydraulic and pneumatic circuits. Figures contained in other divisions may be used and referred to under this division without duplicating them.

3.3.1.2.8 **Section 6 – Parts list.** – This section shall contain identification data covering all repair parts to facilitate ready identification of parts for replacement and ordering purposes. Do not list standard hardware, structural parts, indicating instrument parts or other parts which have no maintenance significance.

3.3.1.2.8.1 **Contents.** – The parts list shall contain the following subdivisions:

(a) Introduction.
(b) Parts tabulation.
(c) Special tools.

3.3.1.2.8.1.1 **Introduction.** – This division shall contain sufficient instructions to explain the following:

(a) Any symbols used for the parts tabulation.
(b) All cross index systems employed.
(c) Titles or other markings intended to segregate different models.
(d) Other information as may be required to facilitate rapid and accurate use of the parts list.

3.3.1.2.8.1.2 **Parts tabulation.** – The parts tabulation shall contain information specified in 3.3.1.2.8.1.2.1 and 3.3.1.2.8.1.2.2 presented in an intelligible sequence. An intelligible sequence may be obtained by listing parts by spatial or functional groups.

3.3.1.2.8.1.2.1 **Tabulation for mechanical parts.** – Tabulation for mechanical parts shall contain the following:

(a) – Figure number. This shall denote the figure number wherein the part has been shown.
(b) – Index number. This number shall denote main assembly, sub-assembly or part identified which is utilized on the reduced size drawing(s) or other figure(s) included in the manual.
(c) – Nomenclature for part using actual manufacturer's name.
(d) – Number required.
(e) – Contractor's service part number.
(f) – Actual manufacturer's service part number.

3.3.1.2.8.1.2.2 **Tabulation for electrical parts.** – Tabulation for electrical parts shall contain the following:

(a) – Figure number. This shall denote the figure number wherein the part has been shown.
(b) – Index number or reference designation (see 3.3.1.2.9.3). This number shall denote main assembly, sub-assembly or part identified which is utilized on the reduced size drawing(s) or other figure(s) included in the manual.
(c) – Nomenclature for part using actual manufacturer's name.
(d) – Number required.
(e) – Contractor's service part number.
(f) – Actual manufacturer's service part number.
(g) – In addition to the requirements of (a) through (f) a separate functional listing by part name shall be stated alongside each part giving the use, purpose, or the function of the part in the assembly.

3.3.1.2.8.1.3 **Special tools.** – A separate list shall immediately follow the parts tabulation under the heading "Special Tools" which are supplied with the equipment; that is, tools that are peculiar to the equipment showing the quantity, unit of issue (each, pair, set), description, and manufacturer's identification number.

3.3.1.2.9 **Section 7 – Drawings.** – This division shall contain reproductions of drawings, additional block diagrams, schematic drawings, and exploded views of explanatory drawings, as necessary to supplement the descriptive matter contained in the text. Diagrams of switches and relays used in the system showing the terminal numbering shall be inserted as additional drawings. The standard color codes for resistors and capacitors shall be stated, where applicable. A sufficient number of reduced size drawings which are prepared in accordance with the standard drawing format shown on Drawing S0103-73729 (see figure 13) shall be included to aid in the identifications of the parts in the "Parts List" (see 3.3.1.2.8). Other figures shall be included to supplement or extend the information contained in the reduced size drawings prepared in accordance with the standard drawing format shown on Drawing S0103-73729 as required for further identification of parts and explanation of the descriptive information contained in the text.

3.3.1.2.9.1 **Symbols.** – Symbols shall be used as necessary. Symbols utilized for the preparation of block diagrams, schematic diagrams, or other explanatory drawings which are not prepared in accordance with Drawing S0103-73729, shall be those contained in the applicable Military Standard as follows:

(a) Symbols for electrical equipment shall be in accordance with Standard MIL-STD-15.
(b) Mechanical symbols shall be in accordance with Standard MIL-STD-17.

3.3.1.2.9.2 **Abbreviations.** – Abbreviations shall be used on drawings only when their meaning is unquestionably clear. Abbreviations when utilized on drawings which are not prepared in accordance with Drawing S0103-73729 shall be in accordance with Standards MIL-STD-12 and MIL-STD-103.

3.3.1.2.9.3 **Reference designations.** – For use on diagrams of electrical circuits which are not prepared in accordance with Drawing S0103-73729 the applicable reference designations contained in Standard MIL-STD-16 shall be utilized. These designations shall be utilized for the purpose of correlating graphical symbols shown thereon with the "Parts List" (see 3.3.1.2.8.1.2.2) and descriptions of, and instructions concerning the circuits. A reference designation *is not* an abbreviation for the name of the part.

3.3.1.2.10 **Memorandum pages.** – Three blank sheets (six pages) shall be inserted at the end of the manual for memorandum purposes. Each page shall be marked "Memorandum" at the top center.

3.3.2 **Format.** –

3.3.2.1 **Volumes.** – Should the summation of information submitted result in an unreasonably bulky manual, the information shall be divided into two or more volumes. The cover of each manual (volume) shall be printed in accordance with figure 1 with the addition of the following as to the respective volume number and the number of volumes comprising the total information furnished; for example, VOLUME I of III; VOLUME II of III; VOLUME III of III. Each volume will be identified by the same NAVSHIPS number (see 3.1.2).

3.3.2.2 **Divisions (chapters or sections).** – Divisions of manuals shall be by chapters or sections, numbered or lettered consecutively (see 3.3.2.5). In general, chapters shall be the main divisions of larger manuals and sections should be the main divisions of smaller manuals. Chapters in larger manuals may be further divided into sections.

3.3.2.3 **Page identification.** – At the top of each page the following shall appear (see figures 9 and 10):

(a) Each left hand page -
  (1) Briefed title of the manual flush with the outside margin.
  (2) Paragraph number flush with the inside margin.
(b) Each right hand page -
  (1) Division, chapter or section number and title flush with the outside margin.
  (2) Paragraph number flush with the inside margin.

3.3.2.4 **Paragraphs.** – Paragraphs shall not be titled or numbered more extensively than is necessary to facilitate reference. Individual paragraph numbering may be omitted, provided the text is so prepared that reference to each paragraph by number is unnecessary. Main paragraphs shall be numbered consecutively within each division, chapter, or section, using Arabic numerals separated by a dash. The number following the dash will indicate the number of the paragraph within the section; for example, "2-17" is the 17th paragraph of section 2. Similarly for manuals subdivided by chapter and section both the chapter and section number shall precede the paragraph number; for example, "2-4-10" is the 10th paragraph of section 4 contained in chapter 2. The main paragraph numbers and title shall stand alone on one line (see figures 9 and 10). It is suggested that individual steps of a step-by-step procedure be identified by step number rather than by paragraph number; for example, Step 1, Step 2, etc.

3.3.2.5 **Numbering.** – Front matter pages shall be numbered in lower case Roman numerals. The cover, title page, and approval and procurement record page shall not be numbered. Pages of the manual(s) shall be numbered consecutively within each division, chapter (or section). Arabic numerals shall be used for numbering for all pages other than the front matter. All odd numbered pages shall appear as right hand pages. Pages, tables, and figures shall be numbered consecutively within each chapter (or section) but each starting with the number "ONE". The page, table, and figure number shall be preceded by the chapter (or section) number. For example, page 3 in section 4 shall be numbered page 4-3; table 5 in section 2 shall be numbered table 2-5; figure 2 in section 1 shall be numbered figure 1-2. Where manuals are divided by chapter and section the chapter and section number both shall precede the pages, table, and figure number. Page numbers shall be placed at the lower outer corner of the page.

3.3.2.5.1 Fold over pages shall be right hand pages printed on one side only and when they are used they shall be assigned two page numbers. The page numbers shall appear on the face of the sheet at the lower righthand corner (see figure 13). Fold over pages shall be arranged so that page numbers and figure numbers are visible without unfolding. Fold over arrangements shall be as shown on figure 13.

3.3.2.6 **Layout treatment.** – The layout of the manuals shall be such as to conserve space without detracting from the utility or clarity of the material presented. Blank pages and spaces shall be avoided wherever possible with the exception specified in 3.3.1.2.10 and in 3.3.2.6.1. Normally, textual material shall be printed on both sides of the sheet. Figures serving no instructional function or to which no reference is made in the text shall not be used. Partial page figures within the text are highly desirable although several small figures may be grouped to form a single page layout. Whenever possible, figures within the text shall be located so that reference can be made from applicable text without turning a page. Whenever it is necessary to include fold over pages they shall be inserted at the end of the applicable division, chapter or section.

3.3.2.6.1 All drawings which are inserted as fold over pages shall be provided with a blank apron page at the left hand edge of the fold over page (see figure 13). This will permit the printed portion in its entirety to be visible while the text is being studied.

3.3.3 **Text.** –

3.3.3.1 **Wording.** – The text shall be factual, specific, concise, and clearly worded so as to be readily understandable to relatively inexperienced personnel involved in the operation and maintenance of the equipment, yet provide technicians with sufficient information to install, operate, service, and maintain the equipment at peak performance. Technical phraseology requiring a specialized knowledge shall be avoided except where no other wording will convey the intended meaning, in which case the technical term shall be defined.

3.3.3.2 **Emphasis.** – When necessary, emphatics such as "NOTE", "CAUTION", and "WARNING" shall be used as adjuncts to the text. These, however, shall be used as sparingly as is consistent with the real need. The appropriate adjunct to the text shall be selected in accordance with the following definition:

(a) "NOTE" – An operating procedure, condition, etc., which it is essential to highlight.

(b) "CAUTION" - Operating procedures, practices, etc., when if not strictly observed, will result in damage or destruction of equipment.

(c) "WARNING" – Operating procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

3.3.3.3 **Grammatical person and mode.** – The second person imperative shall be used for operational procedures; for example: "Disengage jacking gear from main engine reduction gears". The third person indicative shall be used for description and discussion; for example: "The jacking gear rotates the main shaft and main engine by engagement of the main reduction gears".

3.3.3.4 **Nomenclature consistency.** – Nomenclature used shall be consistent throughout the manual. For example, a part once identified as a "cover" shall not be referred to elsewhere as a "plate". That portion of the nomenclature that is used shall agree with the parts list nomenclature.

3.3.3.5 **Tables and charts.** – The use of tables and charts is desirable. Tables and charts shall be as simple as possible with sufficient explanation to make them easily used and understood. When material is presented in tabular form for ready reference purposes, as when listing weights, measures, condensed trouble shooting information, etc., the tabulation shall be numbered by table (or chart) number and chapter (or section) number. Thus, table 3 in chapter 4 shall be numbered table 4-3.

3.3.3.6 **Measures.** – The system of standard U. S. customary units of weights and measures shall be used. As a general rule all references to liquid capacities shall be given in U. S. standard units of liquid measure. When scientific or medical equipment is of a type which makes references to metric weights and measures customary, such references may be used.

3.3.3.6.1 **Temperature references.** – Temperature readings shall be given in degrees Fahrenheit or degrees Centigrade (Celsius), whichever is standard in U. S. industry. (In general, Fahrenheit is used with mechani-

cal equipment and Centigrade (Celsius) is used with electric equipment.) Also, one may follow the other in parentheses, for example: 194°F (90°C) or 90°C (194°F).

3.3.3.7 **Figures.** – A view of each assembly, sub-assembly and the component parts thereof shall be shown as necessary to supplement the text and aid in the identification of parts. Identification of illustrated parts with the listed parts shall be facilitated by the use of key numbers (or more commonly known as piece numbers or index numbers) and arrows which will identify assemblies, sub-assemblies and component parts thereof. Figures of the exploded type may be used. When the use of exploded views is not practical, simple cross sectional views may be used. It is preferable when cross sectional views are used that they be approved drawings or excerpts from approved drawings. In the event no applicable drawing is available, cross sectional views from manufacturer's drawings may be used. Reduced figures for reproduction from validated master figures do not require revalidation.

3.3.3.8 **Figure titles.** – Figure titles shall indicate clearly in a brief descriptive phase what is portrayed, by giving the function or process illustrated, the nomenclature of the equipment shown, or other pertinent and quickly understood identification.

Examples:

(a) Wing hydraulic system.
(b) Model D-3-401 wheel assembly.
(c) Measuring o.d. of clutch cone.
(d) Removing rotor and plate with fixture.

3.3.3.9 **Indexing and referencing of figures.** –

3.3.3.9.1 Significant features or components of figures shall be identified by brief applicable nomenclature with arrows. Index numbers may be used on figures with explanatory legend on the sketch or photo when an extremely large amount of nomenclature is required.

3.3.3.9.2 In order to assure a clear definition of lines where they pass through light and dark areas, arrows (leaders) shall be drawn in black with one edge outlined in white. The arrow head, however, shall be completely outlined in white. The thickness of arrows shall be uniform and no greater than necessary to indicate clearly the desired details.

3.3.3.9.3 Index references and letterings (nomenclature) shall be planned to reproduce uniformly a size not less than 10 point type.

3.3.3.10 **Deleted figures.** – When a change requires deletion of a figure without substitution of another, the following sentence shall be inserted "Figure_____deleted" in or near the place of deletion.

3.3.3.11 **Multiple reference.** – Where references are made in a paragraph to several items in the same figure, as in instructions detailing maintenance procedures, the figure number need be given only once at the beginning of the references (usually the beginning of the paragraph) with index numbers (or reference designation) of the items placed in parentheses in the body of the text where pertinent. Care shall be taken that such references are entirely clear. An example is the following portion of a paragraph:

"10. DISASSEMBLY OF AIR VALVE (see figure 1-5)
a. Unscrew safety disc retainer (2) from valve body (1) and remove safety disc (3) and safety disc washer (4)."

3.3.3.12 **References to figures.** – Where reference is made to figures, the reference shall be to the figure number and the chapter (or section) number. The page number shall not be used. Where reference is made to items shown on figures by index numbers, figure number and index number shall be indicated as follows: "Remove nut (7) and drive out bolt (8) (see figure 1-5)."

3.3.3.13 **Specification and standard references.** – When Government specification or standard numbers are referred to, only the basic numbers shall be mentioned, omitting the revision letter suffix unless it is es-

sential to mention a particular issue of a specification or standard. References to specifications and standards shall be made as follows: "Federal Specification P-S-661", "Military Specification MIL-C-5020", "Military Standard MIL-STD-105", etc. All materials, required for maintenance referred to in the manual, such as lubricants, solvents, additives, scaling materials, abrasives, etc., shall be described by Military Specification numbers where applicable. Commercial designations may be used when there is no applicable Government specification.

3.3.3.14 **Numbers.** – Numbers used at the beginning of a sentence shall be spelled out and followed by the numeral in parentheses.

3.3.4 **Production and reproduction requirements for type II manuals.** –

3.3.4.1 **Graphics.** – The quality of art work for type II manuals (such as photographs, renderings, line drawings and diagrams) shall conform to the quality requirements of Standard MIL-STD-218-2.

3.3.4.1.1 **Photographs.** – Photographic figures shall be prepared with equipment capable of reproducing all details and shall show clearly the subject matter. Photographs shall be uniformly retouched as necessary to define shapes, accentuate details, and establish correct tone value of sufficient contrast for photolithographic reproduction.

3.3.4.1.2 **Exploded views.** – Exploded views may be used for representation of parts of machinery or equipment to show proportionate size, proper relation to other parts, and assembly or disassembly sequence. It is preferable that all parts be exploded in isometric projection of their line of assembly axis (see figure 12).

3.3.4.2 **Color.** – Color shall be used functionally where it is absolutely necessary to show electrical or mechanical circuits, the flow of materials, schematic diagrams or operational diagrams. Cross hatching or similar methods of media shall be employed in lieu of color wherever possible. Color selection shall be based on the primary colors, which may be used in flat combination or screened for texts. A legend on the artwork shall explain the significance of each color used. In no case shall color be used for background or other decorative purpose.

3.3.4.3 **Printing.** – Printing shall be done by either photo-offset, or letterpress method, and shall be of equal quality to first-class commercial work. Reproduction copy may be type-set, varityped, or typewritten with a standard typewriter. In general, type-set copy is preferred with varityped or typewritten copy as second choice. Final typed manuscript shall conform to the requirements of Standard MIL-STD-218-3. The style of composition to be used, however, shall be governed by the quantity of manuals to be produced, the relative costs of the several methods and the availability of material prepared for earlier manuals. The contractor shall specify the method of composition to be used when manuscripts or sample copies are submitted for approval. The bureau or agency concerned may request data from the contractor to substantiate the method of composition chosen if deemed necessary.

3.3.4.3.1 **Arrangement.** – The text may be arranged in the form of either two vertical columns or a single wide column. The two column arrangement shown on figure 10 is preferred; the single column arrangement is shown on figure 9. Right hand margins shall not necessarily have lines flush at the right, but care shall be taken to prepare a generally uniform margin. Final trim size shall be 8-3/8 by 10-7/8 inches. Test shall be printed on both sides except as otherwise specified herein for fold over pages.

3.3.4.4 **Paper.** – The paper for the photo-offset reproduction shall be preferably 25 by 38-50/500 basic offset; for letterpress 25 by 38-70/500 basic dull coated book paper.

3.3.4.5 **Covers.** – Covers for manuals less than ½ inch thick (less cover) shall be of the bellows fold type and of a black fabrikoid material, weight 6-½ to 7-½ ounces per square yard (finished cloth). Covers for manuals over ½ inch thick shall be made of semiflexible board covered with black fabrikoid material, weight 6-½ to 7-½ ounces per square yard. The information shown on figure 1 shall be imprinted in gold, silver, or aluminum color on the cover. Backbones of manuals over ½ inch thickness shall be imprinted with the NAVSHIPS number (Navy identification number) and title in brief. Covers shall overlap the top, bottom, and outside edge of the manual by 3/16 of an inch. Outside corners of the cover shall be slightly rounded.

3.3.4.6 **Binding.** – The binding shall be loose-leaf using 3/16 inch metal posts and screws, top and bottom posts 3/8 inch from the outside edge with the three posts spaced on 4-¼ inch centers. Covers for manuals ½ inch thick or more shall have a binding flange of corrosion-resistant metal covered 700 quality fabrikoid. On manuals

containing less than 50 pages (25 sheets), split type metallic fasteners with metallic washers may be used. All metal parts shall be of corrosion-resisting material, or shall be treated to resist corrosion.

3.3.4.6.1 **Fillers.** – Fillers made of newsboard or similar material shall be inserted where needed to build up the binding edge to the same thickness as the outside edge. Fillers shall be spaced throughout the binding edge of the manual such that the pages of the manual shall not be bent.

3.3.4.7 **Drawings.** – When drawings are necessary to illustrate the description, operation and maintenance of the equipment or system, they shall be reduced in size as necessary (see figure 13) and reproduced in black and white. Each drawing shall be identified with the drawing number of the manufacturer and the bureau or agency concerned. See 3.3.2.6 regarding partial page figures and fold-over pages. Care shall be taken in the preparation of drawings for reproduction to insure that when the drawings are reduced in size they shall be clear and legible.

3.3.4.8 **Figures.** – (NOTE: This paragraph does not pertain to reduced size reproduction of approved drawings which may be extracted and used as figures in a manual.) The rendering of sketches (airbrushing or line rendering) shall be done with the highest possible contrast. Adjoining area of a figure having similar values shall be avoided. Edges of all silhouette half-tone figures shall be sharply defined by retouching. Exploded views and cutaways shall be drawn in perspective to appear as realistic as possible without distortion. Isometric views may be used for small parts or units which lend themselves to this method without showing noticeable distortion. Except for diagrams, schematic, orthographic projections, reproduction of approved drawings, all line sketches shall be prepared with the use of shading medium to clarify and model the form of the sketch. This rendering shall be kept as simple as possible. Fuzzy freehand lines, rendering with fine lines, and cross hatching shall be avoided. Solid black shall be used in dark areas to increase contrast and simplify the sketch. This applies to cutaway views, exploded views and cross section views.

3.3.4.9 **Reproduction copy.** – Reproduction copy shall be prepared in accordance with 3.3.4.3. If offset negatives are used in the publication of the manuals, a complete set of such negatives shall, after completion of the manuals, be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. Regardless of the method of printing used, one glossy print or negative of each halftone figure included in the manuals, shall be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. This requirement does not apply to manuals for which reproduction copy has been previously furnished. Where color is used (see 3.3.4.2) suitable copy for each separate color plate will be rendered properly identified showing register marks. Color plates shall also be forwarded to Naval Supply Depot, Mechanicsburg, Pennsylvania.

3.3.4.10 **Security requirements.** – The security requirements prescribed in Section IX – Graphic Arts of the Industrial Security Manual (DD Form 441-Attachment) shall be observed during the production, reproduction, and distribution of graphic arts involving classified information.

3.4 **Type III manuals.** –

3.4.1 **Contents.** – Type III manuals shall contain the following information as applicable presented in the order specified as follows (see figures 1 to 13 inclusive):

Front matter
Section 1 – General information
Section 2 – Operating instructions.
Section 3 – Installation.
Section 4 – Maintenance.
Section 5 – Parts list.
Section 6 – Drawings.
Memorandum.

Note. – When a manual covers an equipment composed of several distinct units (for example, a pump unit consisting of a pump and motor), it may be necessary to arrange the manual in major divisions, each covering one unit. If so,

the major divisions may be arranged by subdivisions, each corresponding to the requirements listed herein. The order listed herein may be altered with the approval of the bureau or agency concerned.

3.4.1.1 **Front matter.** – The front matter for type III manuals shall consist of the following.

(a) Cover.
(b) Title page.
(c) Approval and procurement record page.
(d) List of effective pages.
(e) Correction page.
(f) Table of contents.
(g) List of figures.
(h) List of tables.

3.4.1.1.1 The list of effective pages shall be required in classified manuals only, and in multiple volume manuals shall be a separate page for the contents of each volume.

3.4.1.1.2 The title page, table of contents, list of figures and list of tables shall be a separate page for the contents of each volume.

3.4.1.1.3 **Approval and procurement record page.** – In all final copies of the manual, the manufacturers shall include an approval and procurement record page inserted immediately following the title page. Figures 3a or 3b gives the format that shall be followed in its preparation.

3.4.1.1.4 **List of effective pages.** – A list of effective pages (see figure 4) shall be prepared for all final manuals classified for security purposes (see 3.1.4) and copies thereof. For multiple volume manuals there shall be prepared a separate list for the contents of each volume.

3.4.1.1.5 **Correction page.** – A correction page (see figure 5) shall be furnished for all final manuals and copies thereof for the purpose of making revisions in accordance with 3.1.6. For multiple volume manuals there shall be prepared a separate correction page for each volume.

3.4.1.1.6 **Table of contents.** – The table of contents (see figure 6) shall list all primary divisions and secondary subdivisions such as chapters, sections, and main paragraphs, with their corresponding paragraph numbers and page numbers. Where submanufacturers are furnishing associated equipment it shall be the responsibility of the prime contractor to integrate and reflect the information provided by the sub-manufacturers within the table of contents.

3.4.1.1.7 **List of figures and drawings.** – A list of figures (see figure 7) which have been assigned figure numbers shall be prepared. This list shall be arranged in numerical sequence, by figure number and shall give the figure title (see 3.4.3.7) and page number.

3.4.1.1.8 **List of tables.** – The list of tables (see figure 8) shall follow the list of figures and drawings. It shall include all tables assigned numbers and shall be arranged in numerical sequence by table numbers.

3.4.1.2 **Section 1 – General information.** – This section shall include general data, an introduction and a detailed description.

3.4.1.2.1 **General data.** – This portion of the manual shall contain the following data:

(a) Component list and performance design characteristics. The name of each component and the respective manufacturer's name with its complete rated performance characteristics for continuous or intermittent operation and, where applicable, maximum permissible overload characteristics and their duration. A description of the items shall be included to distinguish it from other items of the same general category. For instance, a motor shall be distinguished as to the specific type of motor for example, as a.c., synchronous, totally enclosed, etc.
(b) Navy type designation.
(c) Principal overall dimensions.

(d) Weight (with or without packing).
(e) Allowable clearances, temperatures, pressures, pressure and blow range settings or tolerances shall be shown in tabular form.

3.4.1.2.2 **Introduction.** – This division shall include a general description of the equipment; explain briefly what it is, where it is used, and what it will do. All information of a general character applicable to the complete equipment shall be given. When the text contains technical terms, terms not commonly used, or symbols, definitions shall be included.

3.4.1.2.3 **Detailed description.** – This division shall contain a complete detailed description of units and assemblies which comprise the complete equipment; for example ship service turbogenerator, the turbine, reduction gear, generator, and exciter.

3.4.1.2.4 **Section 2 – Operating instructions.** – This division shall contain, simple, brief, and effective instructions, including normal routines and precautions to be observed in starting, operating, stopping or shutting down the equipment. Where operations are to be performed in specific sequence, step-by-step procedure shall be used. Operations shall be numbered in the order in which they are performed. Operating data which is frequently referred to in operating the equipment shall be included in this division. Tables and charts shall be used for the presentation of these instructions where varying operating conditions are encountered.

3.4.1.2.5 **Section 3 – Installation.** – This division shall contain methods of installation, including packing or unpacking, handling, preparation of site, alignment precautions, mounting instructions, bolting diagrams, recommendations regarding shielding, safety guards, grounding or bonding.

3.4.1.2.6 **Section 4 – Maintenance.** – This division shall cover all maintenance procedures and routine adjustments which should be performed periodically, as well as instructions for disassembly and replacement of worn or damaged parts. Instructions on lubrication shall be provided as applicable, preferably in chart form, and shall include the type of lubrication recommended by the manufacturer, together with specific time periods. Lubricants shall be described by Military Specification numbers, where applicable and by commercial designations. Maintenance instructions shall cover the use of special tools.

3.4.1.2.7 **Section 5 – Parts list.** – This section shall contain identification data covering all repair parts to facilitate ready identification of parts for replacement and ordering purposes.

3.4.1.2.7.1 **Contents.** – The parts list shall contain the following information arranged in an intelligible sequence:

(a) – Figure number. This shall denote the figure number whereon the part has been shown.
(b) – Index number. This number shall denote main assembly, subassembly or part identity on the reduced size drawing(s) or other figure(s) included in the manual. (This column may be eliminated when the part is identified by name on a figure.)
(c) – Nomenclature for part using actual manufacturer's name.
(d) – Number required.
(e) – Actual manufacturer's service part numbers.

3.4.1.2.7.2 **Special tools.** – A separate list shall immediately follow the parts tabulation under the heading "Special Tools" which are supplied with the equipment, that is, tools that are peculiar to the equipment showing the quantity, unit of issue (each, pair, set) description, and manufacturer's identification number.

3.4.1.2.8 **Section 6 – Drawings.** – This division shall contain drawings, additional block diagrams, exploded views or explanatory drawings, as necessary to supplement the descriptive matter contained in the text. Diagrams of switches and relays used in the system showing the terminal numbering shall be inserted as additional drawings. The standard color codes for resistors and capacitors shall be stated, where applicable.

3.4.1.2.9 **Memorandum pages.** – One blank sheet (two pages) shall be inserted at the end of the manual for memorandum purposes.

3.4.2 **Format.** –

3.4.2.1 **Volumes.** – Should the summation of information submitted result in an unreasonably bulky manual, the information shall be divided into two or more volumes. The cover of each manual (volume) shall be printed in accordance with figure 1 with the addition of the following as to the respective volume number and the number of volumes comprising the total information furnished; for example, VOLUME I of III, VOLUME II of III, VOLUME III of III. Each volume shall be identified by the same NAVSHIPS number (see 3.1.2).

3.4.2.2 **Divisions (chapters or sections).** – Divisions of manuals shall be by chapters or sections, numbered or lettered consecutively (see 3.4.2.5). In general, chapters shall be the main divisions of larger manuals and sections shall be the main divisions of smaller manuals. Chapters of larger manuals may be further divided into sections.

3.4.2.3 **Page identification.** – At the top of each left hand page, flush with the outside margin, shall appear a briefed title of the manual. At the top of each right hand page, flush with the outside margin, shall appear the division, chapter, or section title.

3.4.2.4 **Paragraphs.** – Paragraphs shall not be titled or numbered more extensively than is necessary to facilitate reference. Individual paragraph numbering may be omitted, provided the text is so prepared that reference to each paragraph by number is unnecessary. Main paragraphs shall be numbered consecutively within each division, chapter or section, using Arabic numerals separated by a dash. The number following the dash will indicate the number of the paragraph within the section; for example, "2-17" is the 17th paragraph of section 2. Similarly for manuals subdivided by chapter and section both the chapter and section number shall precede the paragraph number; for example, "2-4-10" is the 10th paragraph of section 4 contained in chapter 2. The main paragraph numbers and title shall stand alone on one line (see figures 9 and 10).

3.4.2.5 **Numbering.** – Front matter pages shall be numbered in lower case Roman numerals. The cover, title page, and approval and procurement record pages shall not be numbered. Pages of the manual(s) shall be numbered consecutively within each division, chapter (or section). Arabic numerals shall be used for numbering for all pages other than the front matter. All odd numbered pages shall appear as right hand pages. Pages, tables, and figures which are referred to in the manual shall be numbered consecutively within each chapter (or section) but each starting with the number "ONE". The page, table, and figure number shall be preceded by the chapter (or section) number. For example, page 3 in section 4 shall be numbered page 4-3, table 5 in section 2 shall be numbered table 2-5, figure 2 in section 1 shall be numbered figure 1-2. Where manuals are divided by chapter and section the chapter and section number both shall precede the page, table, and figure number. Page numbers shall be placed at the lower outer corner of the page.

3.4.2.5.1 Fold over pages shall be right hand pages printed on one side only and when they are used they shall be assigned two page numbers. The page numbers shall appear on the face of the sheet at the lower right hand corner (see figure 13). Fold over pages shall be arranged so that page numbers and figure numbers are visible without unfolding. Fold over arrangements shall be as shown on figure 13.

3.4.2.6 **Layout treatment.** – The layout of the manuals shall be such as to conserve space without detracting from the utility or clarity of the material presented. Blank pages and spaces shall be avoided wherever possible with the exception specified in 3.4.1.2.9 and in 3.4.2.6.1. Normally, textual material shall be printed on both sides of the sheet. Figures serving no instructional function or to which no reference is made in the text shall not be used. Partial page figures within the text are preferred although several small figures may be grouped to form a single page layout. Whenever possible, figures within the text shall be located so that reference can be made from applicable text without turning a page. Whenever it is necessary to include fold over pages they shall be inserted at the end of the applicable division, chapter or section.

3.4.2.6.1 All drawings which are inserted as fold over pages shall be provided with a blank apron page at the left hand edge of the fold over page (see figure 13). This will permit the printed portion in its entirety to be visible while the text is being studied.

3.4.3 **Text.** –

3.4.3.1 **Wording.** – The text shall be factual, specific, concise, and clearly worded so as to be readily understandable to relatively inexperienced personnel involved in the operation and maintenance of the equipment, yet provide technicians with sufficient information to install, operate, service, and maintain the equipment at peak performance. Technical phraseology requiring a specialized knowledge shall be avoided except where no other wording will convey the intended meaning, in which case the technical term shall be defined.

3.4.3.2 **Emphasis.** – When necessary, emphatics such as "NOTE", "CAUTION", and "WARNING" shall be used as adjuncts to the text. These, however, shall be used as sparingly as is consistent with the real need. The appropriate adjunct to the text shall be selected in accordance with the following defintions:

(a) "NOTE" – An operating procedure, condition, etc., which it is essential to highlight.
(b) "CAUTION" – Operating procedures, practices, etc., when if not strictly observed, will result in damage or destruction of equipment.
(c) – "WARNING" – Operating procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

3.4.3.3 **Grammatical person and mode.** – The second person imperative shall be used for operational procedures; for example: "Disengage jacking gear from main engine reduction gears." The third person indicative shall be used for description and discussion; for example: "The jacking gear rotates the main shaft and main engine by engagement of the main reduction gears."

3.4.3.4 **Nomenclature consistency.** – Nomenclature used shall be consistent throughout the manual. For example, a part once identified as a "cover" shall not be referred to elsewhere as a "plate". That portion of the nomenclature that is used shall agree with the parts list nomenclature.

3.4.3.5 **Tables and charts.** – The use of tables and charts is desirable. Tables and charts shall be as simple as possible with sufficient explanation to make them easily used and understood. When material is presented in tabular form for ready reference purposes, as when listing weights, measures, condensed trouble shooting information, etc., the tabulation shall be numbered by table (or chart) number and chapter (or section) number. Thus table 3 in chapter 4 shall be numbered table 4-3.

3.4.3.6 **Measures.** – The system of standard U. S. customary units of weights and measures shall be used. As a general rule all references to liquid capacities shall be given in U. S. standard units of liquid measure. When scientific or medical equipment is of a type which makes reference to metric weights and measures customary, such reference may be used.

3.4.3.6.1 **Temperature reference.** – Temperature readings shall be given in degrees Fahrenheit or degrees Centigrade (Celsius), whichever is standard in U. S. industry. (In general, Fahrenheit is used with mechanical equipment and Centigrade (Celsius) is used with electric equipment.) One may follow the other in parentheses, for example: 194°F. (90°C) or 90°C. (194°F.).

3.4.3.7 **Figures.** – A view of each assembly, sub-assembly and the component parts thereof shall be shown as necessary to supplement the text and aid in the identification of parts. Identification of illustrated parts with the listed parts shall be facilitated by the use of key numbers (or more commonly known as piece numbers or index numbers) and arrows which will identify assemblies, sub-assemblies, and component parts. Figures of the exploded type may be used. When the use of exploded views is not practical, simple cross sectional views may be used. It is preferable when cross sectional views are used that they be approved drawings or excerpts from approved drawings. In the event no applicable drawing is available, cross sectional views from manufacturer's drawings may be used. Reduced figures for reproductions from validated master figures do not require revalidation.

3.4.3.8 **Figure titles.** – Figure titles shall indicate clearly in a brief descriptive phrase what is portrayed, by giving the function or process illustrated, the nomenclature of the equipment shown, or other pertinent and quickly understood identification.

Examples:

(a) Wing hydraulic system.

(b) Model D-3-401 wheel assembly.
(c) Measuring o.d. of clutch cone
(d) Removing rotor and plate with fixture.

3.4.3.9 **Indexing and referencing of figures.** –

3.4.3.9.1 Significant features or components of figures shall be identified by brief applicable nomenclature with arrows. Index numbers may be used on figures with explanatory legend on the sketch or photo when an extremely large amount of nomenclature is required.

3.4.3.9.2 In order to assure a clear definition of lines where they pass through light and dark areas, arrows (leaders) shall be drawn in black with one edge outlined in white. The arrow head, however, shall be completely outlined in white. The thickness of arrows shall be uniform and no greater than necessary to indicate clearly the required details.

3.4.3.9.3 Index references and letterings (nomenclature) shall be planned to reproduce uniformly a size not less than 10 point type.

3.4.3.9.4 **Deleted figures.** – When a change requires deletion of a figure without substitution of another, the following sentence shall be inserted "Figure_____deleted" in or near the place of deletion.

3.4.3.9.5 **Multiple reference.** – Where references are made in a paragraph to several items in the same figure, as in instructions detailing maintenance procedures, the figure number need be given only once at the beginning of the references (usually the beginning of the paragraph) with index numbers (or reference designations) of the items placed in parentheses in the body of the text where pertinent. Care shall be taken that such references are entirely clear. An example is the following portion of a paragraph:

"10. DISASSEMBLY OF AIR VALVE (see figure 1-5)
a. Unscrew safety disc retainer (2) from valve body (1) and remove safety disc (3) and safety disc washer (4)"

3.4.3.9.6 **Reference to figures.** – Where reference is made to figures, the reference shall be to the figure number and the chapter (or section) number. The page number shall not be used. Where reference is made to items shown on figures by index numbers, figure number and index number shall be indicated as follows: "Remove nut (7) and drive out bolt (8) (see figure 1-5)."

3.4.3.9.7 **Specification and standard references.** – When Government specifications or standard numbers are referred to, only the basic numbers shall be mentioned, omitting the revision letter suffix unless it is essential to mention a particular issue of a specification or standard. References to specifications and standards shall be made as follows: "Federal Specification P-S-661", "Military Specification MIL-C-5020", "Military Standard MIL-STD-105", etc. All materials required for maintenance referred to in the manual, such as lubricants, solvents, additives, sealing materials, abrasives, etc., shall be described by military specification numbers where applicable. Commercial designations may be used when there is no applicable government specification.

3.4.3.9.8 **Numbers.** – Numbers used at the beginning of a sentence shall be spelled out and followed by the numeral in parentheses.

3.4.4 **Production and reproduction for type III manuals.** –

3.4.4.1 **Graphics.** – The quality of art work for type III manuals (such as photographs, renderings, line drawings and diagrams) shall conform to the quality requirements of Standard MIL-STD-218-2.

3.4.4.1.1 **Photographs.** – Photographic figures shall be prepared with equipment capable of reproducing all details and shall show clearly the subject matter. Photographs shall be uniformly retouched as necessary to define shapes, accentuate details, and establish correct tone value of sufficient contrast for photolithographic reproduction.

3.4.4.1.2 **Exploded views.** – Exploded views may be used for representation of parts of machinery or equipment to show proportionate size, proper relation to other parts, and assembly or disassembly sequence. It is preferable that all parts be exploded in isometric projection on their line of assembly axis (see figure 12).

3.4.4.2 **Color.** – Color shall be used functionally where it is absolutely necessary to show electrical or mechanical circuits, the flow of materials, schematic diagrams or operational diagrams. Cross hatching or similar methods of media shall be employed in lieu of color wherever possible. Color selection shall be based on the primary colors, which may be used in flat combination or screened for texts. A legend on the artwork shall explain the significance of each color used. In no case shall color be used for backgrounds or other decorative purpose.

3.4.4.3 **Printing.** – Printing shall be done by either photo-offset, or letterpress method, and shall be of equal quality to first class commercial work. Reproduction copy may be type-set, varityped, or typewritten with a standard typewriter. In general, type-set copy is preferred with varityped or typewritten copy as second choice. Final typed manuscript shall conform to the requirements of Standard MIL-STD-218-3. The style of composition to be used, however, shall be governed by the quantity of manuals to be produced, the relative costs of the several methods and the availability of material prepared for earlier manuals. The contractor shall specify the method of composition to be used when manuscripts or sample copies are submitted for approval. The bureau or agency concerned may request data from the contractor to substantiate the method of composition chosen if deemed necessary.

3.4.4.3.1 **Arrangement.** – The text may be arranged in the form of either two vertical columns or a single wide column. The two column arrangement shown on figure 10 is preferred; the single column arrangement is shown on figure 9. Right hand margins shall not necessarily have lines flush at the right, but care shall be taken to prepare a generally uniform margin. Final trim size shall be 8-3/8 by 10-7/8 inches. Text shall be printed on both sides except as otherwise specified herein for fold over pages.

3.4.4.4 **Paper.** – The paper for the photo-offset reproduction shall be preferably 25 by 38-50/500 basic offset; for letterpress 25 by 38-70/500 basic dull coated book paper.

3.4.4.5 **Covers.** – Covers for manuals less than ½ inch thick (less cover) shall be of the bellows fold type and of a black fabrikoid material, weight 6-½ to 7-½ ounces per square yard (finished cloth). Covers for manuals over ½ inch thick shall be made of semiflexible board covered with black fabrikoid material, weight 6-½ to 7-½ ounces per square yard. The information shown on figure 1 shall be imprinted in gold, silver, or aluminum color on the cover. Backbones of manuals over ½ inch thick shall be imprinted with the NAVSHIPS number (Navy identification number) and title in brief. Covers shall overlap the top, bottom, and outside edge of the manual by 3/16 of an inch. Outside corners of the cover shall be slightly rounded.

3.4.4.6 **Binding.** – The binding shall be loose-leaf using 3/16 inch metal posts and screws, top and bottom posts 3/8 inch from the outside edge with the three posts spaced on 4-¼ inch centers. Covers for manuals ½ inch thick or more shall have a binding flange of corrosion-resistant metal covered 700 quality fabrikoid. On manuals containing less than 50 pages (25 sheets), split type metallic fasteners with metallic washers may be used. All metal parts shall be of corrosion - resisting material, or shall be treated to resist corrosion.

3.4.4.6.1 **Fillers.** – Fillers made of newsboard or similar material shall be inserted where needed to build up the binding edge to the same thickness as the outside edge. Fillers shall be spaced throughout the binding edge of the manual such that the pages of the manual shall not be bent.

3.4.4.7 **Drawings.** – When drawings are necessary to illustrate the description, operation and maintenance of the equipment or system, they shall be reduced in size as necessary (see figure 13) and reproduced in black and white. Each drawing shall be identified with the drawing number of the manufacturer and the bureau or agency concerned. Also see 3.4.2.5 regarding partial page figures and fold over pages. Care shall be taken in the preparation of drawings for reproduction to insure that when the drawings are reduced in size they shall be clear and legible.

3.4.4.8 **Figures.** – (NOTE: This paragraph does not pertain to reduced size reproduction of approved drawings which may be extracted and used as figures in a manual). The rendering of sketches (airbrushing or line rendering) shall be done with the highest possible contrast. Adjoining area of a figure having similar values shall be avoided. Edges of all silhouette halftone figures shall be sharply defined by retouching. Exploded views and cutaway views shall be drawn in perspective to appear as realistic as possible without distortion. Isometric views may

be used for small parts or units which lend themselves to this method without showing noticeable distortion. Except for diagrams, schematics, orthographic projections, reproduction of approved drawings, all line sketches shall be prepared with the use of shading medium to clarify and model the form of the sketch. This rendering shall be kept as simple as possible. Fuzzy freehand lines, rendering with fine lines, and cross hatching shall be avoided. Solid black shall be used in dark areas to increase contrast and simplify the sketch. This applies to cutaway views, exploded views and cross section views.

3.4.4.9 **Reproduction copy.** – Reproduction copy shall be prepared in accordance with 3.4.4.3. If offset negatives are used in the publication of the manuals, a complete set of such negatives shall, after completion of the manuals, be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. Regardless of the method of printing used, one glossy print or negative of each *halftone* figure included in the manuals, shall be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. This requirement does not apply to manuals for which reproduction copy has been previously furnished. Where color is used (see 3.4.4.2) suitable copy for each separate color plate will be rendered properly identified showing register marks. Color plates shall be forwarded to Naval Supply Depot, Mechanicsburg, Pennsylvania.

3.4.5 **Security requirements.** – The security requirements prescribed in Section IX – Graphic Arts of the Industrial Security Manual (DD Form 441 – Attachment) shall be observed during the production, reproduction and distribution of graphic arts involving classified information.

3.5 **Type IV manuals.** –

3.5.1 **Contents.** – Type IV manuals shall consist of manufacturer's standard commercial instructions and parts lists bound together. Production drawings prepared for the manufacture of the equipment(s) when required may be included to supplement the standard manufacturer's instructions. All final manuals shall include an approval and procurement record page (see figures 3a and 3b).

3.5.2 **Covers.** – Covers shall be of a black fabrikoid or leatheroid material. The cover shall bear the information shown on figure 1 and shall be located in accordance with the format shown thereon.

3.5.3 **Binding.** – The manual and covers shall be bound either by stapling, stitching or by use of metal binding posts.

3.6 **Distribution requirements.** –

3.6.1 Unless otherwise specified in the contract or order, distribution of all *final manuals not exactly identical* to ones previously procured and assigned a NAVSHIPS number shall be as follows:

(a) Two copies packed with each unit of equipment procured but not to exceed six for ultimate placement aboard a single ship shall be provided. The requirement for concurrent delivery of these manuals with the equipment cannot be over emphasized since they are absolutely essential for effective shipboard installation, operation and maintenance of the equipment for which they are supplied.
(b) Two copies to the Bureau of Ships.
(c) Two copies to the cognizant Supervisor of Shipbuilding when the equipment is to be installed by a private shipyard.
(d) One copy to each U. S. Naval Shipyard, except Pearl Harbor and Portsmouth Naval Shipyards (total of nine).
(e) Two copies to the Commander, Pearl Harbor Naval Shipyard (for submarine equipment and surface ship equipment).
(f) Two copies to the Commander, Portsmouth Naval Shipyard (for submarine equipment only).
(g) One copy to the cognizant Inspector of Naval Material.
(h) Two copies to the Submarine Supply Office, Philadelphia, Pennsylvania (submarine equipment only).
(i) Two copies to all Submarine Tenders (submarine equipment only).
(j) Two copies to the Commander, Submarine Base, New London, Connecticut (submarine equipment only).
(k) Three copies to the Commanding Officer, Ships Parts Control Center, Mechanicsburg, Pennsylvania.

(l) Two copies of the approval and procurement record page, (see figures 3a or 3b) to the Commanding Officer, Ships Parts Control Center, Mechanicsburg, Pennsylvania, (for record purposes only).

(m) Two copies of the approval and procurement record page, (see figures 3a or 3b) to the Bureau of Ships (for record purposes only).

(n) Manuals for stock shall be in the following quantities:

Number of equipments	*Number of copies*
1 to 10	5 plus 1 per equipment
11 to 25	25
26 to 40	35
41 to 60	50
61 to 100	65
101 to 150	80
151 to 200	100
201 and over	1 for every 2 identical equipments procured

These manuals shall be shipped to:

Commanding Officer
Naval Supply Depot
(For Stock)
Mechanicsburg, Pennsylvania

3.6.2 Unless otherwise specified in the contract or order, distribution of all final manuals exactly identical to ones previously procured and approved (as evidenced by a previously assigned NAVSHIPS number) (see figures 3a and 3b) shall be as follows:

(a) Two copies packed with each unit of equipment procured but not to exceed six for ultimate placement aboard a single ship shall be provided. The requirement for concurrent delivery of these manuals with the equipment cannot be over emphasized since they are absolutely essential for effective shipboard installation, operation and maintenance of the equipment for which they are supplied.

(b) Two copies to the cognizant Supervisor of Shipbuilding when the equipment is to be installed by a private shipyard.

(c) Two copies of the approval and procurement record page, (see figures 3a or 3b) to the Commanding Officer, Ships Parts Control Center, Mechanicsburg, Pennsylvania, (for record purposes only).

(d) Two copies of the approval and procurement record page, (see figures 3a or 3b) to the Bureau of Ships, (for record purposes only).

3.6.3 Unless otherwise specified in the contract or order, distribution of all final manuals for ships being constructed, reactivated, converted or otherwise readied for transfer under the Mutual Defense Assistance Program (MDAP) shall be as follows:

(a) Two copies packed with each unit of equipment procured but not to exceed six for ultimate placement aboard ship shall be provided. The requirement for concurrent delivery of these manuals with the equipment cannot be over emphasized since they are absolutely essential for effective shipboard installation, operation and maintenance of the equipment for which they are supplied.

(b) Six copies per equipment for each ship to be transferred under MDAP to a foreign government. These copies shall be sent to the Military Assistance Advisory Group (MAAG) of the recipient country for delivery to the foreign government which is to receive the ship.

(c) One copy to the Washington, D. C. Naval Attache of the foreign government to receive the ship.

(d) Two copies to the Bureau of Ships.

(e) One copy to the cognizant Supervisor of Shipbuilding when the equipment is to be installed at a private yard.

(f) One copy to the cognizant Inspector of Naval Material.

(g) Twelve copies to:

Commanding Officer
Naval Supply Depot
(For Stock)
Mechanicsburg, Pennsylvania

(h) Two copies of the approval and procurement record page (see figures 3a or 3b) to the Commanding Officer, Ships Parts Control Center, Mechanicsburg, Pennsylvania (for record purposes).

(i) Two copies of the approval and procurement record page, (see figures 3a or 3b to the Bureau of Ships (for record purposes only).

3.7 **Workmanship.** – The workmanship shall be of high quality, comparable in text, compilation, arrangement, and accuracy to high grade commercial manuals and parts catalogs and shall be satisfactory to the bureau or agency concerned. Copy which has filled letters or is blurred will not be acceptable.

4. QUALITY ASSURANCE PROVISIONS

4.1 **Approval procedures.** – The methods of approval shall be as specified in 3.1.8.1.

4.2 **Inspection procedures.** – For Naval purchases, the general inspection procedures shall be in accordance with the General Specifications for Inspection of Material.

5. PREPARATION FOR DELIVERY

5.1 **Manuals accompanying equipment.** – One or two copies, as specified in the contract or order, of the manual shall be packed within the shipping container holding the main unit of equipment. The manual(s) shall be so placed that they are readily accessible prior to removing the equipment and shall not be placed within the water vaporproof barrier material used to enclose the equipment. Manuals accompanying equipment shall be packaged in accordance with method 1C-3 of Specification MIL-P-116 except the manuals accompanying the equipment packed by level C shall be packaged in accordance with commercial practice. The packing list shall indicate which container includes the manuals.

5.2 **Bulk manuals.** –

5.2.1 **Packing.** –

5.2.1.1 **Level A.** – Manuals, in multiples of 10 when practical, shall be packed in overseas type wood cleated fiberboard, nailed wood, wirebound wood, corrugated or solid fiberboard, wood cleated paper overlaid, or wood cleated plywood boxes, conforming to Specifications PPP-B-591, PPP-B-621, PPP-B-585, class 2 or 3, JAN-P-108, MIL-B-10377 or PPP-B-601, respectively. Shipping containers shall have caseliners conforming to Specification MIL-L-10547 and shall be closed and sealed in accordance with the appendix thereto. Caseliners for boxes conforming to Specification JAN-P-108 may be omitted provided all joints of the boxes are sealed with tape as specified in the appendix of the box specification. Box closures shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.1.2 **Level B.** – Manuals, in multiples of 10 when practical, shall be packed in domestic type wood cleated fiberboard, nailed wood, wirebound wood, corrugated or solid fiberboard, wood cleated plywood, or wood cleated paper overlaid boxes conforming to Specifications PPP-B-591, PPP-B-621, PPP-B-585, LLL-B-631, LLL-B-636, PPP-B-601 or MIL-B-10377, respectively. Closures shall be as specified in the applicable box specification or appendix thereto. Fiberboard boxes shall conform to the special requirement of the applicable box specification. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.1.3 **Level C.** – Manuals shall be packed in a manner to insure safe delivery and acceptance at destination. Containers shall comply with the Consolidated Freight Classification Rules or other carrier regulations applicable to the mode of transportation.

5.2.2 **Security requirements.** – All classified material shall be prepared for delivery in accordance with DD441 (ATTACHMENT).

5.3 **Marking.** – In addition to any special marking specified in the contract, order, or herein, each unit and intermediate package and shipping container shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

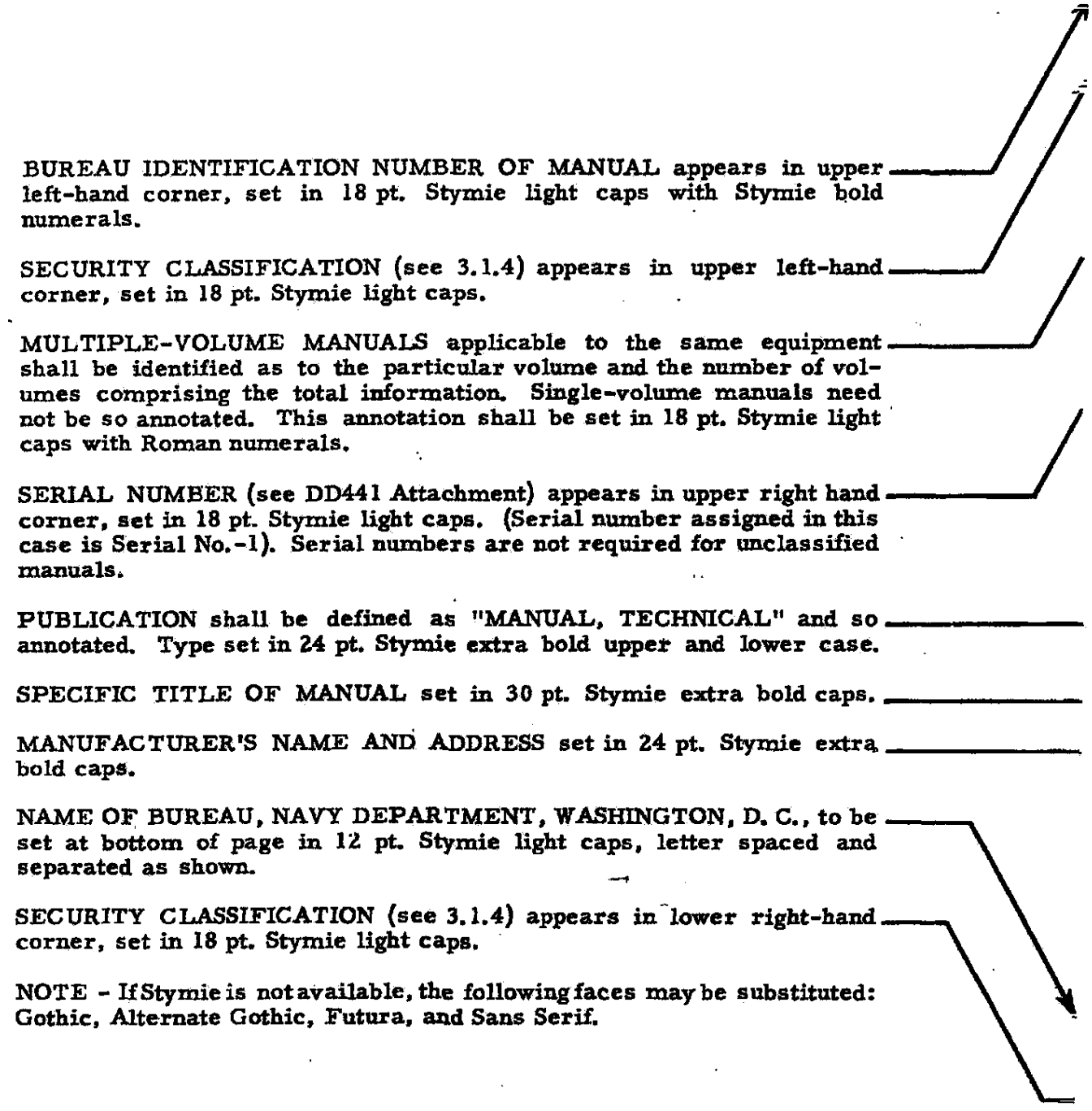
6.1 **Ordering data.** – Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type of manual required (see 1.2).
(c) Security classification, if required (see 3.1.4).
(d) Special requirements for type I manuals (see 3.2) when appropriate.
(e) Quantity of preliminary manuals required, delivery date and delivery destination(s).
(f) Quantity of final manuals required, delivery date, and delivery destination(s) (see 3.6).
(g) Details of special requirements for drawings, charts, and illustrations, pertinent to the particular equipment, if not covered by the equipment specification.
(h) Levels of packing required (see 5.1 and 5.2).

6.2 **Superseding data.** – Types of manuals have been superseded as follows:

MIL-T-15071B	MIL-M-15071C
Type A	Type I
Type B	Type II
Type C	Type III
Type D	Type IV

Notice. – When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.



BUREAU IDENTIFICATION NUMBER OF MANUAL appears in upper left-hand corner, set in 18 pt. Stymie light caps with Stymie bold numerals.

SECURITY CLASSIFICATION (see 3.1.4) appears in upper left-hand corner, set in 18 pt. Stymie light caps.

MULTIPLE-VOLUME MANUALS applicable to the same equipment shall be identified as to the particular volume and the number of volumes comprising the total information. Single-volume manuals need not be so annotated. This annotation shall be set in 18 pt. Stymie light caps with Roman numerals.

SERIAL NUMBER (see DD441 Attachment) appears in upper right hand corner, set in 18 pt. Stymie light caps. (Serial number assigned in this case is Serial No.-1). Serial numbers are not required for unclassified manuals.

PUBLICATION shall be defined as "MANUAL, TECHNICAL" and so annotated. Type set in 24 pt. Stymie extra bold upper and lower case.

SPECIFIC TITLE OF MANUAL set in 30 pt. Stymie extra bold caps.

MANUFACTURER'S NAME AND ADDRESS set in 24 pt. Stymie extra bold caps.

NAME OF BUREAU, NAVY DEPARTMENT, WASHINGTON, D. C., to be set at bottom of page in 12 pt. Stymie light caps, letter spaced and separated as shown.

SECURITY CLASSIFICATION (see 3.1.4) appears in lower right-hand corner, set in 18 pt. Stymie light caps.

NOTE - If Stymie is not available, the following faces may be substituted: Gothic, Alternate Gothic, Futura, and Sans Serif.

NAVSHIPS 300-0000 VOLUME I OF III

SECURITY CLASSIFICATION SERIAL NO.-1

TECHNICAL MANUAL

450-KW AC/DC GENERATOR SET STEAM-TURBINE

MANUFACTURER'S NAME AND ADDRESS

BUREAU OF SHIPS - NAVY DEPARTMENT - WASHINGTON, D. C.

SECURITY CLASSIFICATION

FIGURE 1 - TYPICAL COVER

SECURITY CLASSIFICATION (see 3.1.4) appears in upper right-hand corner set in 18 pt. Stymie light caps.

BUREAU IDENTIFICATION NUMBER OF MANUAL appears in upper left-hand corner, set in 18 pt. Stymie light caps with Stymie Bold numerals.

SERIAL NUMBER (see DD441 Attachment) appears in upper left-hand corner, set in 18 pt. Stymie light caps. (Serial number assigned in this case is Serial No.-1). Serial numbers are not required for unclassified manuals.

MULTIPLE-VOLUME MANUALS applicable to the same equipment shall be identified as the particular volume and the number of volumes comprising the total information. Single-volume manuals need not be so annotated. This annotation shall be set in 18 pt. Stymie light caps with Roman numerals.

TYPE OF MANUAL (see 1.2) set in 24 pt. Stymie extra bold upper case.

PUBLICATION shall be defined as "MANUAL, TECHNICAL" and so annotated. Type set in 24 pt. Stymie extra bold upper case.

SPECIFIC TITLE OF MANUAL set in 30 pt. Stymie bold upper case.

"WARNING" paragraph shall be set in 8 pt. Stymie bold caps (see 3.1.4). This paragraph not required for unclassified manuals.

MANUFACTURER'S NAME AND ADDRESS set in 24 pt. Stymie extra bold caps.

CONTRACT NO. may, at the discretion of the manufacturer, be hand lettered, stamped or typewritten on the title page in lieu of being printed.

"NOTICE FOR REQUISITIONING" shall be set in 24 pt. Stymie extra bold caps.

MANUFACTURER'S BOOK NUMBER OR IDENTIFICATION.

NAME OF BUREAU, NAVY DEPARTMENT, WASHINGTON, D. C., to be set at bottom of page in 12 pt. Stymie light caps.

DATE OF MANUAL may, at the discretion of the manufacturer, be hand lettered, stamped or typewritten on the title page in lieu of being printed.

SECURITY CLASSIFICATION (see 3.1.4) appears in lower right-hand corner set in 18 pt. Stymie light caps.

NOTE: If Stymie is not available, the following faces may be substituted: Gothic, Alternate Gothic, Futura, and Sans Serif. Weights shown shall be maintained.

SERIAL NO.-1

VOLUME I OF III

SECURITY CLASSIFICATION

NAVSHIPS 300-0000

TYPE - I

TECHNICAL MANUAL

450-KW AC/DC GENERATOR SET STEAM-TURBINE

"WARNING: This material contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law."

MANUFACTURER'S NAME AND ADDRESS

CONTRACT NObs 00000

NOTICE: Additional copies of this or other manuals may be obtained from the U. S. Naval Supply Depot, Mechanicsburg, Pennsylvania. Manuals requested on equipment for which a NAVSHIPS identification number is not known may be obtained by furnishing complete identification plate data, service application and other characteristics of the equipment to aid in the identification of the applicable manual.

MANUFACTURER'S BOOK NUMBER

BUREAU OF SHIPS - NAVY DEPARTMENT - JUNE 1956

SECURITY CLASSIFICATION

FIGURE 2 - TYPICAL TITLE PAGE

PAGE HEADING FOR IDENTIFICATION.

BASIC APPROVAL DATA shall include the applicable letters or correspondence granting approval in conformance with approval procedure specified in 3.1.8.1.

COLUMN HEADINGS FOR LISTING NECESSARY DATA.

DATA shall be listed in sequence by contract date with the latest contract appearing last as illustrated.

REMARKS space reserved for comments.

CERTIFICATION paragraph and date.

MANUFACTURER'S SIGNATURE.

NOTES:

1. This page is to be made of the same paper as the remainder of the manual and may be typed or printed. It shall be inserted within the manual immediately following the title page.

2. A manufacturer shall list only the present contract or order and two previous contracts or orders. Manufacturers with less than three previous contracts or orders shall list all previous contracts or orders.

3. This figure applies to preliminary and final manuals which are identical to those previously furnished. For preliminary and final manuals being furnished for the first time, see figure 3B.

9999906 2107170 829

APPROVAL AND PROCUREMENT RECORD

BASIC APPROVAL DATA FOR: NAVSHIPS 300-0000,

TITLE

Bureau of Ships letter Serial 544-654 of 18 April 1953. NAVSHIPS 300-0000 Model 67DR Dishwashing Machine. Supervisor of Shipbuilding, USN and Naval Inspector of Ordnance, New York Serial 34567-987 of 16 March 1953, AKA150 Class/S45/11/8.

CONTRACT OR ORDER	DATE	VESSELS APPLICABLE	QUANTITY OF MANUALS	BUILDING YARD
917-7896-W1897	2-16-53	AKA156 DE113	56	A Shipyard Company Gamble, New York
NObs-76813	3-17-54	DE789 CVE888	45	B Iron Works Leadville, Penna.
NObs-67000	4-18-55	AMS198 SS111	8	C Iron Works Bath, Maine

REMARKS:

None.

CERTIFICATION: **DATE** 1-1-56

It is hereby certified that the manuals to be provided under this contract (or order No.) Nobs-67000 are exactly identical to NAVSHIPS 300-0000 approved by authority of basic approval data shown above. Further it is certified that this identical manual has been provided under other contracts or orders as listed above.

MANUFACTURER'S SIGNATURE

FIGURE 3A, APPROVAL AND PROCUREMENT RECORD PAGE

PAGE HEADING FOR IDENTIFICATION.

BASIC APPROVAL DATA shall include the applicable letters or correspondence granting approval in conformance with approval procedure specified in 3.1.8.1.

COLUMN HEADINGS FOR LISTING NECESSARY DATA.

REMARKS space reserved for comments.

CERTIFICATION paragraph and date.

MANUFACTURER'S SIGNATURE.

NOTES:

1. This page is to be made of the same paper as the remainder of the manual and may be typed or printed. It shall be inserted within the manual immediately following the title page.

2. The manufacturer shall list the contract or order under which the final manual is being furnished for the first time.

3. This figure applies to preliminary and final manuals which are being furnished for the first time. For preliminary and final manuals identical to those previously furnished, see figure 3A.

9999906 2107172 6T1

APPROVAL AND PROCUREMENT RECORD

BASIC APPROVAL DATA FOR: NAVSHIPS 300-0000,

TITLE

Manual - Leslie Pump Pressure Governors and Strainers for Fuel Oil Service Pumps, NAVSHIPS 300-0000.

Approved by New York Naval Shipyard letter 252:ETE:mk, CVA62/S48 of 5 November 1956.

CONTRACT OR ORDER	DATE	VESSELS APPLICABLE	QUANTITY OF MANUALS	BUILDING YARD
N140(131)56253B	12-29-55	CVA62	28	New York Naval Shipyard Naval Base Brooklyn 1, New York

REMARKS:

CERTIFICATION: **DATE** 4-27-56

It is hereby certified that the manual, NAVSHIPS 300-0000, provided under this contract (or order No.) N140(131)56253B, has been approved by authority of basic approval data shown above.

MANUFACTURER'S SIGNATURE

FIGURE 3B, APPROVAL AND PROCUREMENT RECORD PAGE

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Original	4-1 through 4-25	Original
APR Page			
iii through vi	Original	5-1 through 5-20	Original
1-1 through 1-4	Original	6-1 through 6-28	Original
2-1 through 2-10	Original	7-1 through 7-15	Original
3-1 through 3-8	Original		

Figure 4 – List of effective pages

RECORD OF CORRECTIONS MADE

PAGES	NUMBERS	DATE	SIGNATURE
Revised	1-6 through 1-8	2/56	John R. Smith
Revised	3-7 through 3-9	6/56	John R. Smith
New	2-14.1 through 2-14.3	7/56	John R. Smith
Revised	3-10 through 3-12	12/56	John R. Smith
Supplementary	3-14.1 through 3-14.3	2/57	John R. Smith

Figure 5 – Record of corrections made

TABLE OF CONTENTS

DIVISION ONE-ENGINE

Figure 6 – Table of contents

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CHAPTER 5 – MAINTENANCE

Figure 6 (Cont.)

CHAPTER 6 – PARTS LISTS

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Section 2 – Basic Engine

Section 3 – Fuel System

Section 4 – *Starting System*

Section 5 – Governor System

Figure 6 (Cont.)

Figure 6 (Cont.)

Contents

MEMORANDUM

Figure 6 (Cont.)

LIST OF FIGURES AND DRAWINGS

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CHAPTER 2 – PRINCIPLES OF OPERATIONS

Section 1 – Basic Engine Cycles

CHAPTER 3 – OPERATING INSTRUCTIONS

Section 1 – Operating Procedures

CHAPTER 4 – INSTALLATION INSTRUCTIONS

Section 1 – Initial Installation

CHAPTER 5 – MAINTENANCE

Section 2 – Basic Engine

Figure 7 – List of Figures and Drawings

Section 3 – Fuel System

Section 4 – Starting System

Section 5 – Governor System

Section 6 – Lubrication System

Section 7 – Cooling System

Section 9 – Air Induction Systems

Section 10 – Instrument and Controls

Figure 7 (Cont.)

CHAPTER 7 – DRAWINGS

Section 1 – General

Section 2 – Basic Engine

Section 3 – Fuel System

Section 4 – Starting System

Section 5 – Governor System

Figure 7 (Cont.)

Section 6 – Lubrication System

Section 7 – Cooling System

Section 8 – Exhaust System

Section 9 – Air Induction System

Section 10 – Instruments and Controls

MEMORANDUM

Figure 7 (Cont.)

SECURITY CLASSIFICATION

LIST OF TABLES

Figure 8 – List of tables

SECTION I

INITIAL INSTALLATION

4-1-1 General.

Prior to shipment the engines, driven machinery and all connecting parts have been carefully tested, individually and in combination as complete units. The engines have had ample "run-in" and final inspection.

Installation drawings showing the over-all installation dimensions and clearances, as well as the location of all connecting piping flanges, are included at the end of this chapter. Fresh and sea water cooling, lubricating oil, air and fuel oil piping to be done by the shipbuilder and also shown in schematic diagrams on the installation drawings. Where possible, temporary cone-type strainers should be installed in the lines and removed upon completion of trials.

Diagrams and instructions for installation of the generator and switchgear will be found in the generator manufacturer's instruction book, Volume II.

Installation should be as described in the installation plans and the following instructions to insure good operating conditions for the engines and associated equipment.

For operators and repair base personnel, the installation specifications are of secondary importance. They should understand, however, those factors which, if altered or not kept in repair, might reduce the efficiency of or damage the engine and associated equipment.

4-1-2 Assembly.

The generator sets are completely assembled to the subbase, aligned and tested prior to shipment.

The sets are protected against vibration during shipment by the insertion of paper under the inertia flywheel and the generator pedestal bearing caps and under the generator brushes. The inertia flywheel is cushioned on a rubber pad and two wooden wedges are installed on each side between the flywheel and subbase cross member. The paper must be removed from under the bearing caps and the wedges removed from between the flywheel and subbase before the machinery can be rotated.

4-1-3 Mounting.

The foundations upon which the generator set subbase on propulsion engine mounting rails are to rest must be level athwartships and in parallel planes. All subbase and mounting bolts should be checked and torqued to the value specified before final installation and coupling alignment.

4-1-4 Coupling Alignment.

Sufficient time should be allowed after launching to permit swelling and tightening of the ships timbers and the ship should be weighted to the loaded waterline before the reduction gear and propeller shafts are finally aligned. At this time the alignment of the generator set subbases and foundations should be rechecked and the engine-to-fly-

Figure 9 – Page identification

wheel and flywheel-to-generator couplings broken and the alignment checked. Alignment procedures are illustrated in Figure 4-1-1 below.

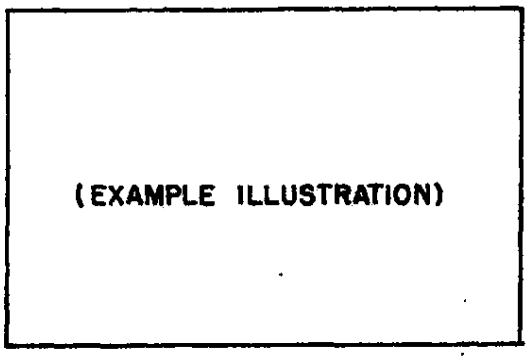


FIGURE 4-1-1 COUPLING ALIGNMENT

When measuring the face-to-face distance of the coupling, the shaft of the engine drive assembly should be pulled back toward the coupling to take up the end of the shaft.

If the coupling face-to-face distance is not as specified, the unit must be shifted ahead on its mounting and secured, after which the clearance and alignment should be rechecked before completion of the installation.

SECTION I

INITIAL INSTALLATION

4-1-1 General

Prior to shipment – the engines, driven machinery, and all connecting parts have been carefully tested, individually and in combination as complete units. The engines have had ample "run-in" and final inspection.

Installation drawings showing the over-all installation dimensions and clearances, as well as the location of all connecting piping flanges, are included at the end of this chapter. Fresh and sea water cooling, lubricating oil, air and fuel oil piping to be done by the shipbuilder and also shown in schematic diagrams on the installation drawings. Where possible, temporary cone-type strainers should be installed in the lines and removed upon completion of trials.

Diagrams and instructions for installation of the generator and switchgear will be found in the generator manufacturer's instruction book, Volume II.

Installation should be as described in the installation plans and the following instructions to insure good operating conditions for the engines and associated equipment.

For operators and repair base personnel, the installation specifications are of secondary importance. They should understand, however, those factors which, if altered or not kept in repair, might reduce the efficiency of or damage the engine and associated equipment.

4-1-2 Assembly.

The generator sets are completely assembled to the subbase, aligned and tested prior to shipment.

The sets are protected against vibration during shipment by the insertion of paper under the inertia flywheel and the generator pedestal bearing caps and under the brushes. The inertia flywheel is cushioned on a rubber pad and two wooden edges are installed on each side between the flywheel and subbase cross member. The paper must be removed from under the bearing caps and the wedges removed from between the flywheel and subbase before the machinery can be rotated.

4-1-3 Mounting.

The foundation upon which the generator set subbase on propulsion engine mounting rails are to rest must be level athwartships and in parallel planes. All subbase and mounting bolts shoud be checked and torqued to the value specified before final installation and coupling alignment.

4-1-4 Coupling Alignment.

Sufficient time should be allowed after launching to permit swelling and tightening of the ships timbers and the ship should be weighted to the loaded waterline before the reduction gear and propeller shafts are finally aligned. At this time the alignment of the generator set subbases and foundations should be rechecked and the engine-to flywheel and flywheel-to-generator couplings broken and the alignment checked. Alignment procedures are illustrated in Figure 4-1-1 below.

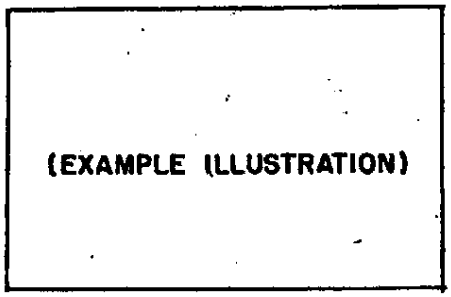


FIGURE 4-1-1 COUPLING ALIGNMENT

When measuring the face-to-face distance of the coupling, the shaft of the engine drive assembly should be pulled back toward the coupling to take up the end play of the shaft.

If the coupling face-to-face distance is not as specified, the unit must be shifted ahead on its mounting and secured, after which the clearance and alignment should be rechecked before completion of the installation.

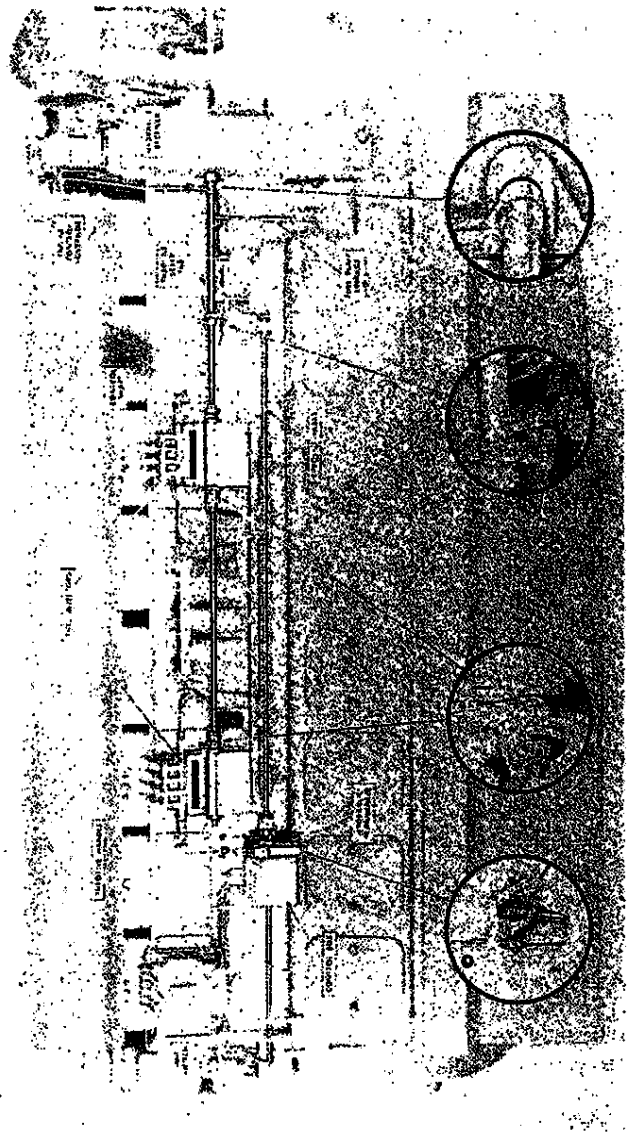
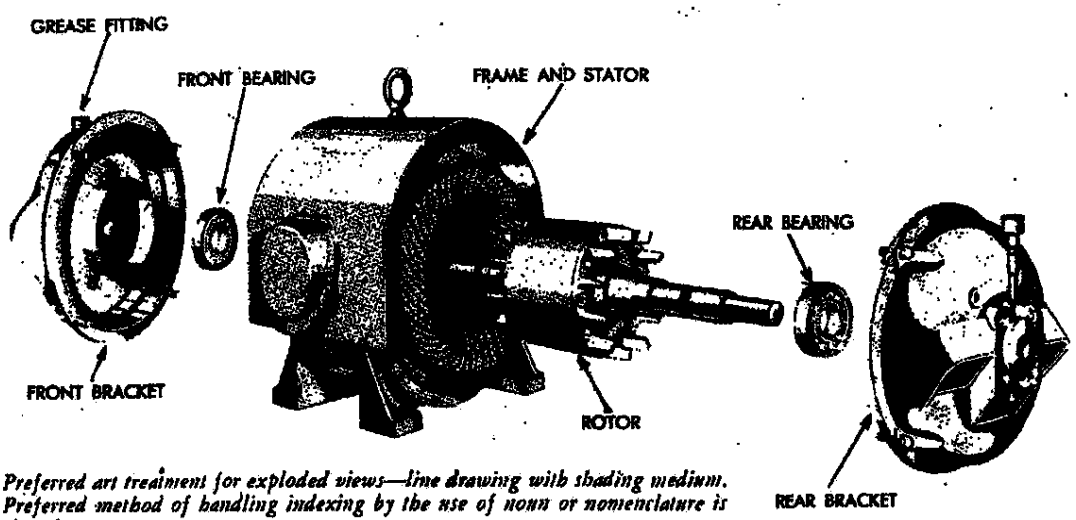
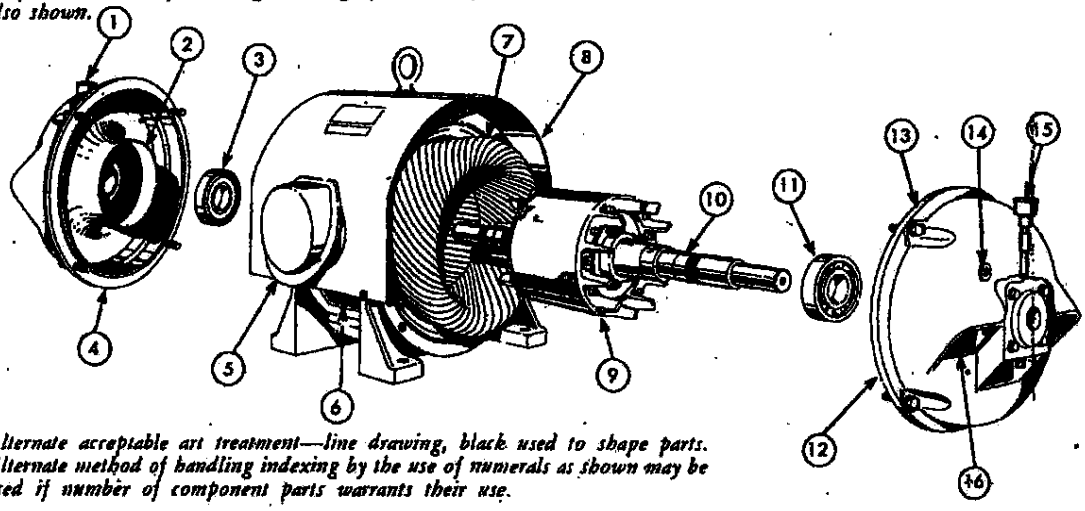


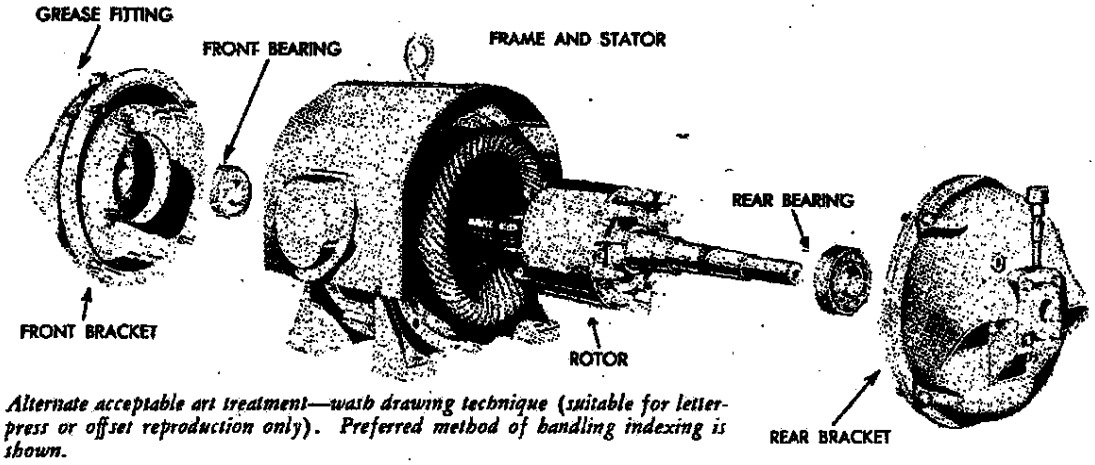
Figure 11. Engine control system.



Preferred art treatment for exploded views—line drawing with shading medium. Preferred method of handling indexing by the use of noun or nomenclature is also shown.



Alternate acceptable art treatment—line drawing, black used to shape parts. Alternate method of handling indexing by the use of numerals as shown may be used if number of component parts warrants their use.



Alternate acceptable art treatment—wash drawing technique (suitable for letterpress or offset reproduction only). Preferred method of handling indexing is shown.

NOTE.—Where letterpress or offset reproduction is to be employed, well-retouched photographs, exploded as per drawing shown above will also be acceptable.

Figure 12. Art treatment for exploded views.

SECURITY CLASSIFICATION

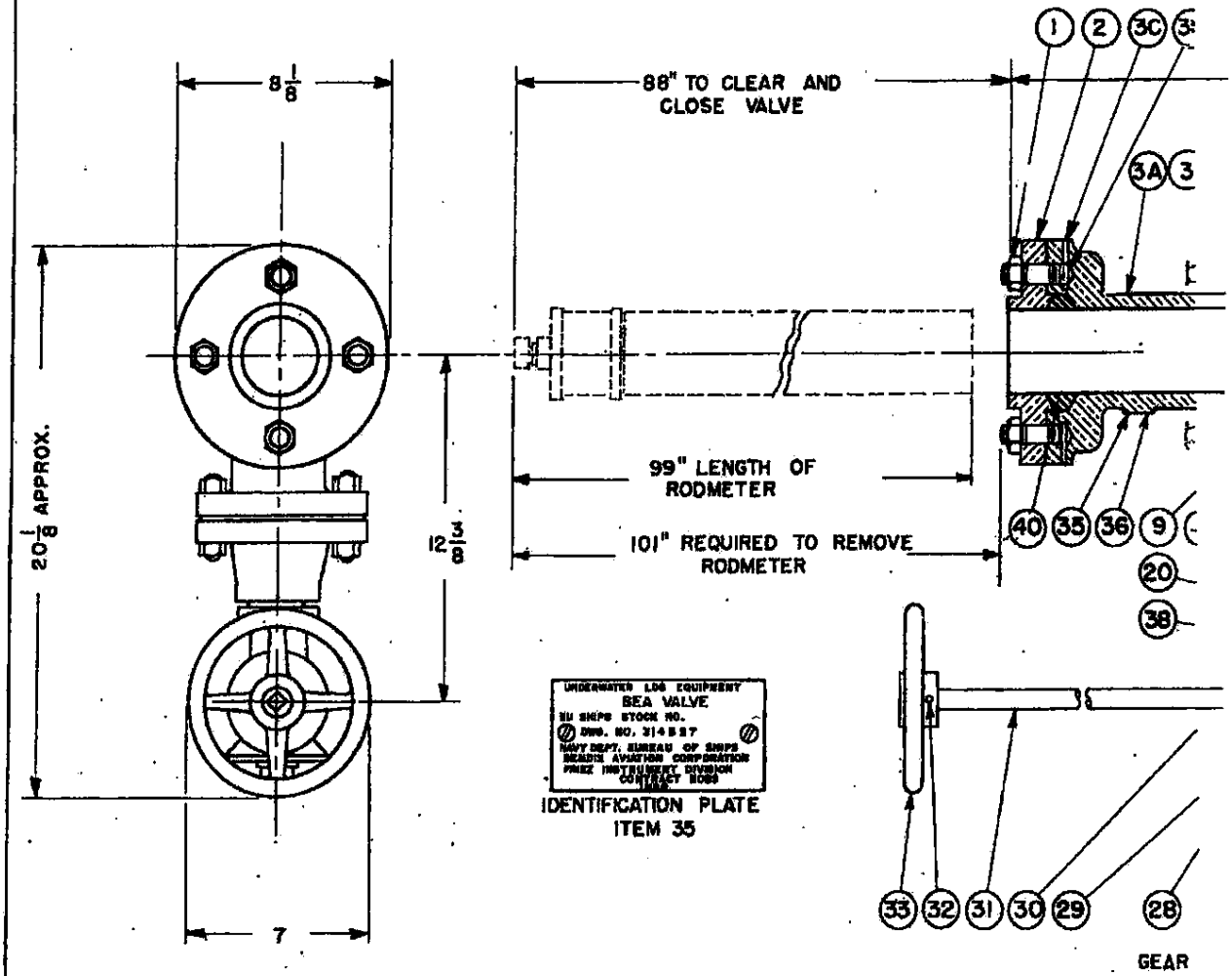
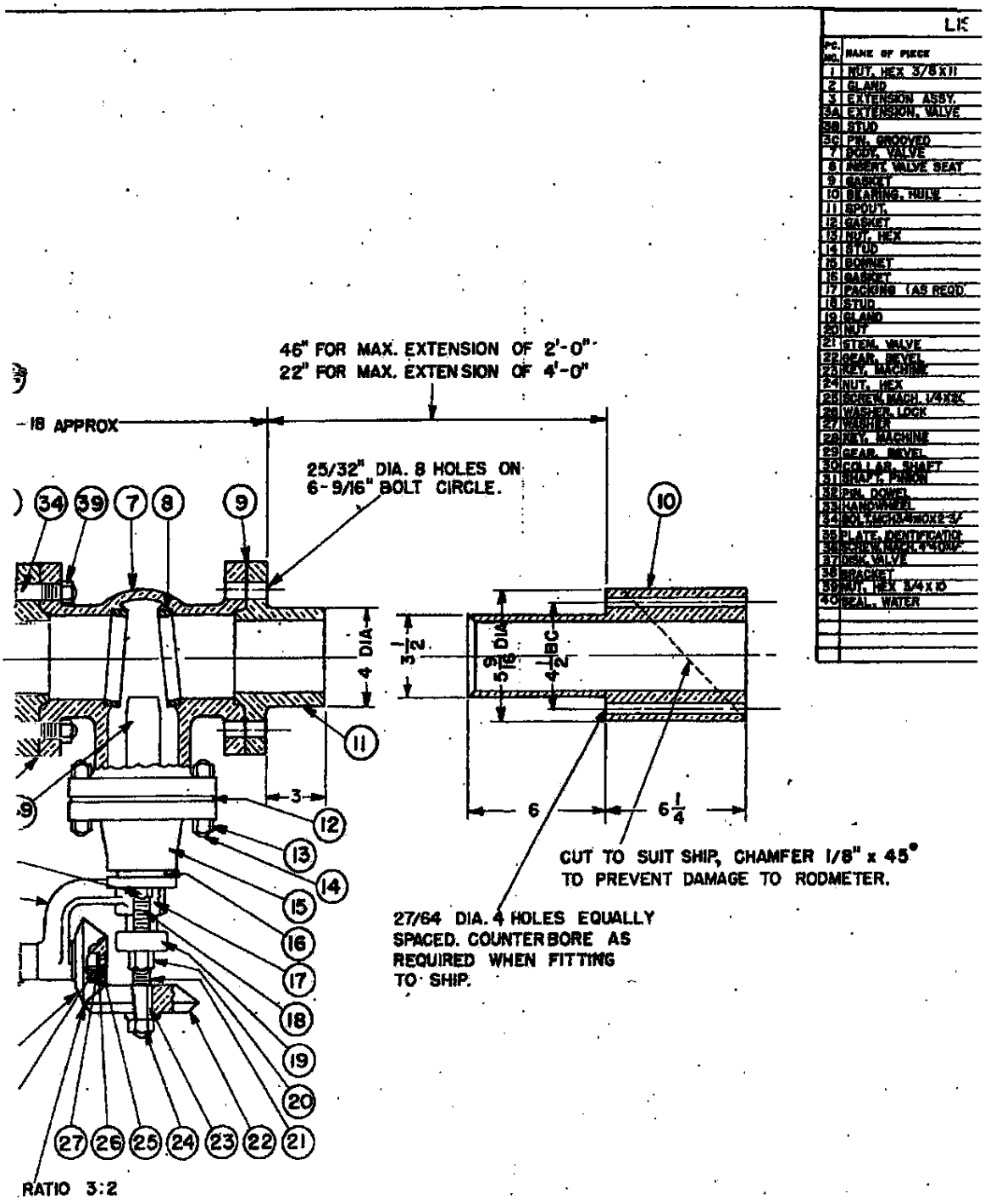


Figure 13.–Reduced size



PC. NO.	NAME OF PIECE
1	NUT, HEX 3/8 X 11
2	GLAND
3	EXTENSION ASSY.
3A	EXTENSION, VALVE
3B	STUD
3C	PIN, GROOVED
7	BODY, VALVE
8	INSERT, VALVE SEAT
9	GASKET
10	BEARING, HULL
11	SPOUT
12	GASKET
13	NUT, HEX
14	STUD
15	BONNET
16	GASKET
17	PACKING (AS REQD)
18	STUD
19	GLAND
20	NUT
21	STEM, VALVE
22	GEAR, BEVEL
23	KEY, MACHINE
24	NUT, HEX
25	SCREW, MACH. 1/4 X 3/4
26	WASHER, LOCK
27	WASHER
28	KEY, MACHINE
29	GEAR, BEVEL
30	COLLAR, SHAFT
31	SHAFT, PINION
32	PIN, DOWEL
33	HANDWHEEL
34	BOLT, EYE (1/4 NOM X 2-3/
35	PLATE, IDENTIFICATION
36	SCREW, MACH. 4-40 NC
37	DISK, VALVE
38	BRACKET
39	NUT, HEX 1/4 X 10
40	SEAL, WATER

drawing with blank apron page to illustrate fold-over arrangement.

Part 2 of 52

T OF MATERIAL QUANTITIES FOR ONE SEA VALVE

NO. REQ	MATERIAL	SPECIFICATION NUMBER	CONTRACTOR SERVICE Spec NO. PT NO.	MANUFACTURER SERVICE PT. NAME OR PLAN NO.	BU SHIPS SYS NO.	UNIT WT. LB.	STD NAVY STOCK NO.	REMARKS
4	MONEL	QQ-N-281	314738-1-A					
1	MONEL	QQ-N-281	314746-A					
1			314743-1-A					
1	BRONZE	MIL-B-16541	314745-A					
4	MONEL	QQ-N-281	314735-A					
4	STEEL		314734-A					ZINC PLATE
1	BRONZE	MIL-B-16541						
2	MONEL	MIL-N-20184						
2	RUBBER	MIL-R-1149	314739-A					
1	BRONZE	MIL-B-16541	314741-A					
1	BRONZE	MIL-B-16541	314742-A					
1	RUBBER	MIL-R-1149						
16	MONEL	QQ-N-281						
8	MONEL	QQ-N-281						
1	BRONZE	MIL-B-16541						
1	RUBBER	MIL-R-1149						
	ADJUST SCREW	MIL-P-17677						SYMBOL 1104
2	MONEL	QQ-N-281						
1	MONEL	QQ-N-281						
4	MONEL	QQ-N-281						
1	MONEL	QQ-N-281						
1	GEAR BRONZE							P.D. 5 N.T. 80
1	MONEL	QQ-N-281						
1	MONEL	QQ-N-281						
1	MONEL	QQ-N-281						
1	STEEL							ZINC PLATE
1	BRASS							
1	MONEL	QQ-N-281						
1	GEAR BRONZE							P.D.3.333 N.T.20
1	BRASS	MIL-R-894						
1	BRASS	MIL-R-894						
1	PHOS BR	MIL-B-892						
1	BRASS	MIL-B-17668						
8	MONEL	QQ-N-281	314737-A					
1	MONEL	QQ-N-281	314736-A					
2	BRASS							
1	MONEL	MIL-N-20184						
1	BRONZE	MIL-B-16541						
8	MONEL	QQ-N-281	314738-2-A					
1	RUBBER	MIL-R-900	314740-A					

REVISIONS						
REVISIONS		DESCRIPTION	MFR. DATE APP'D	MFR. DATE APP'D	USN DATE APP'D	USN DATE APP'D

NOTES:

1. Pinion shaft, item 31, is furnished 56" long (from center line of valve) length to be cut to suit ship and handwheel pinned in place. Necessary bearing for shaft to be furnished by others.
2. At installation, item 10 and 11 must be rigidly held in alignment.
3. Where spec. no. is not noted, material of best commercial grade to be used.
4. Valve made in accordance with spec. MIL-V-20231 class II except as noted.
5. Components exposed to hydrostatic pressure shall withstand without damage or operational failure hydrostatic pressure of 550 lbs. per square inch for one hour.

SECURITY CLASSIFICATION

DRAWN BY	MASTER PLAN	BENDIX AVIATION CORPORATION PRICE INSTRUMENT DIVISION BALTIMORE, MARYLAND
CHECKED BY	UNDERWATER LOG EQUIPMENT (IMPELLER TYPE)	DWG. NO. 314737
CHIEF DRAFT.		NAVY DEPT. BU SHIPS
APP'D BY	SEA-VALVE ASSEMBLY	CONTRACT NOBS 47763
APP'D DATE		BU SHIPS NO.
DRAFT'M.	BU SHIPS STOCK NO.	DESIGN H 5008778
TITLE	STD NAVY STOCK NO.	
	SCALE 6" = 1" UNIT WT. 288 LBS.	

SECURITY CLASSIFICATION